COMMERCIAL FISHERIES Review

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COVER: A biologist collects sample of the catch.

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Managing Editor: Edward Edelsberg
Asst. Managing Editor: Barbara Lundy

Production: Jean Zalevsky
Alma Greene

The Bureau of Commercial Fisheries and
The Bureau of Sport Fisheries and Wildlife
make up The Fish and Wildlife Service of
The United States Department of the Interior.

Throughout this book, the initials BCF stand
for the Bureau of Commercial Fisheries.

Address correspondence and requests to: Commercial Fisheries Review, 1801 North Moore Street, Room 200, Arlington, Va. 22209. Telephone: Area Code 703 - 557-4246.

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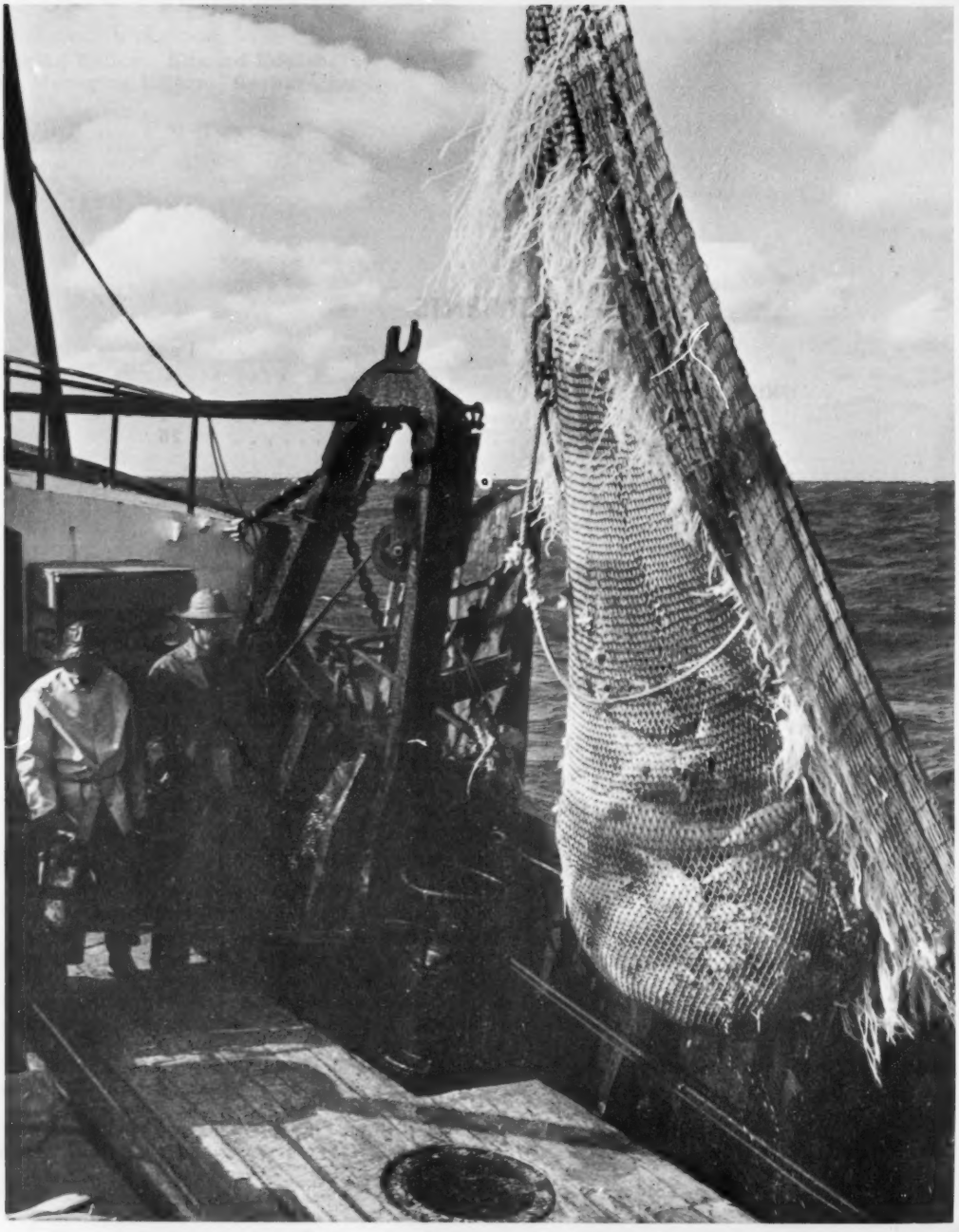


Cod-end swinging aboard BCF-chartered vessel during explorations off South Carolina. (Photo: J. B. Rivers)

GROUP APPOINTED TO ADVISE INTERIOR ON MARINE AFFAIRS

A Marine Affairs Action Group has been appointed to advise Interior Department on strengthening its marine programs, Secretary Walter J. Hickel announced on Jan. 20, 1970.

Dr. John C. Calhoun Jr. was named chairman of an 8-man group of leaders in science and industry specializing in marine activities. Dr. Calhoun is vice president for programs and director of the sea grant program, Texas A & M University, and former science adviser to Interior.

Background & Mission

Secretary Hickel explained: "Since I became Secretary, I have given priority attention to this Department's marine programs. Interior's budget for ocean affairs is about 35 percent of the total federal civilian effort in marine activities. Scattered among some 11 bureaus and offices, however, these Departmental programs require greater coordination and integration.

"A start in this direction was made through the establishment of the Office of Marine Resources. It has become apparent, however, that a stronger organizational thrust is needed.

"This need has been given increased urgency by the recent announcement of the Administration's five-point initiative in the field of ocean science and marine resource development. In two of these programs, this Department has been assigned lead agency responsibility, namely, Coastal Zone Management and the establishment of Coastal Zone Laboratories. If we are to meet our increasing responsibilities for developing the ocean's resources and for protecting the nation's marine environment, we must streamline our management structure.

"Accordingly, I have selected a special Marine Affairs Action Group and directed it to recommend a detailed restructuring of departmental entities engaged in marine related activities toward the specific end of efficiently achieving priority objectives. This task will include:

"(1) A complete review of this Department's marine programs;

"(2) An examination of the recommendations and conclusions of recent ocean policy studies, including the report of the Commission on Marine Science, Engineering and Resources;

"(3) A selection of concrete departmental goals for ocean use and development, in light of new Administration directives; and

"(4) A determination of relative priorities for these goals and time frames for their attainment."

The Group

Secretary Hickel also appointed these members of the Marine Affairs Action group:

Dr. Douglas L. Brooks, Special Assistant to the Director, National Science Foundation;

Dr. John V. Byrne, Chairman, Department of Oceanography, Oregon State University;

Wilbert M. Chapman, Director, Marine Resources, Ralston Purina Company;

Dr. Earl G. Droessler, Vice President for Research, University of New York at Albany;

Dr. Mason L. Hill, former Manager of Exploration, International Division, Atlantic Richfield Company;

Taylor A. Pryor, President, The Oceanic Foundation, Hawaii;

Dr. Lyle St. Amant, Director, Louisiana Wildlife and Fisheries Commission.

HICKEL ENDORSES LAKE SUPERIOR POLLUTION REPORT

Secretary of the Interior Walter J. Hickel endorsed on Jan. 29 the recommendations of a 1969 conference dealing with pollution in Lake Superior. He urged water-pollution-control agencies in Minnesota, Wisconsin, and Michigan to ensure that the recommendations are effectively carried out.

The conference was convened May 13-15, 1969, and reconvened Sept. 30-Oct. 1, 1969, in Duluth, Minn. It sought measures to curb contamination of Lake Superior, the largest, deepest, and cleanest of the Great Lakes. One topic discussed was the daily discharge into the lake of thousands of tons of taconite tailings by the Reserve Mining Co. in Silver Bay, Minn.

Conference Recommendations

The conference recommended the development of guidelines by a specially appointed committee to tighten water-quality standards in Lake Superior. It called for continuing surveillance of Reserve's taconite discharges--and for company efforts to reduce these.

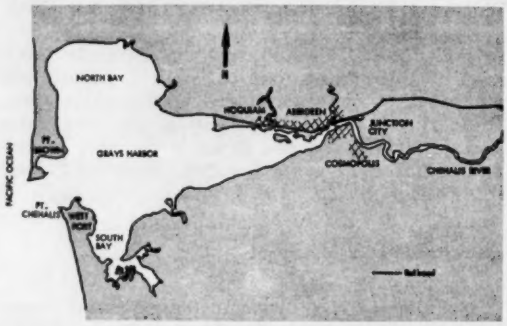
Federal and state agencies were asked to strengthen their surveillance procedures in the Lake Superior Basin to detect more effectively changes in water quality. A minimum of secondary treatment was recommended for all municipalities discharging wastes into the lake and its tributaries.

Eliminate Oil

The conference report urged the elimination of visible discharges of oil from any source--and prohibition of the dumping of polluted dredged material into the lake. Also recommended was adoption of uniform state requirements for controlling wastes from water craft.

CONSTRUCTION OF FPC PLANT IN WASHINGTON STATE BEGINS

Groundbreaking ceremonies marking the start of construction of a demonstration plant that will produce Fish Protein Concentrate (FPC) were held Jan. 31 at Aberdeen, Wash.



"The plant will be a major step forward in developing the technology needed to produce FPC in quantity," said Dr. Leslie L. Glasgow, Assistant Secretary of the Interior for Fish and Wildlife, Parks, and Marine Resources.

FPC has been produced under laboratory conditions and in a small model unit by BCF scientists.

Aberdeen Plant's Purpose

The Aberdeen plant will demonstrate the technical and economic feasibility of producing FPC in large quantities. Information resulting from the design, processing, and costs of manufacture will be made available to interested companies--so the technologic advances achieved can be applied to commercial production.

Dr. Glasgow noted that many species of fish rich in protein are now used for industrial purposes, or are not harvested at all. "I see FPC as only the start of a new concept in utilizing these vast aquatic resources and converting them into high quality protein for human benefit."

U. S. TUNA FLEET EXPANDS

On Jan. 1, 1968, the carrying capacity of the U. S. tuna fleet (including bait boats) was about 43,600 tons, reports BCF's Pacific Southwest Region. During 1968, capacity increased by 4,710 tons--to about 48,310 tons.

In 1969, the fleet added 8,000 tons of new capacity and lost about 700 tons through sinkings.

It is estimated that 9,400 tons will be added in 1970. Including 1970 preliminary estimates, the fleet will have increased 49.1% in 3 years.

EASTROPAC OBSERVATIONS MADE AVAILABLE TO TUNA FISHERMEN

Observations during the Eastern Tropical Pacific (EASTROPAC) cruises have been made available to tuna fishermen, discloses BCF's Pacific Southwest Region. The fishermen had expressed much interest in the oceanographic information collected during these cruises. The information may help them locate and catch tuna.

Cruise Reports

One report contains information dealing with seabird, porpoise, whale, and surface tuna school observations. Another report in preparation will contain summaries of "surface temperature, mixed layer depth, water clarity, forage, seabird, porpoise and tuna school sightings for winter and summer months in three areas outside the regions where the U.S. tuna fleet has historically fished."

Oceanographic Information Valuable

BCF Pacific Southwest adds: "Since tuna fishing operations are being extended beyond the traditional fishing regions, oceanographic information which may aid in locating tuna in the new areas is of prime interest to fishermen."

INTERNATIONAL FISHERIES SURVEY CONTINUES OFF CALIFORNIA

The Soviet fishery research vessel 'Ogon' arrived in Port of Los Angeles, Calif., January 26 to join BCF scientists in a survey of Pacific hake populations off California.

The object is to continue the assessment begun last year by U.S. and Soviet fishery scientists. In recent years, these hake stocks have been fished heavily by the Soviet fleet. Data are needed to provide a scientific basis for agreements to protect the species.

Hake are recognized in the U.S. as valuable raw material for producing fish protein concentrate.

U. S. AND JAPANESE TUNA EXPERTS CONFER AT BCF MIAMI LAB

Japanese scientists of the Far Seas Fisheries Research Laboratory, Shimuzu, spent the first week of January 1970 as guests of BCF's Tropical Atlantic Biological Laboratory (TABL) in Miami. The scientists, all experts in the biology and ecology of tunas, arrived in Florida Dec. 30, 1969, aboard the 'Shoyo Maru,' research vessel of Japan's Fisheries Agency.

The ship is well known to the world's tuna researchers. She left Tokyo in October 1969 on a 6-month Pacific fishery-oceanography investigation--off Mexico and Panama, then in the Atlantic Ocean. She departed Miami for Tokyo, Jan. 6, 1970, retracing her route.

Led By Dr. Ueyanagi

The Japanese group was led by Dr. Shoji Ueyanagi, renowned tuna researcher. He was accompanied by Yasuo Nishigawa and Yoshio Nonagami, also of the Shimuzu laboratory. Joining the vessel at Guayaquil, Ecuador, was Phillipe Serene of the French CNEXO Tuna Program and Dr. Phillip Edmunds, U.S. Bureau of Sport Fisheries and Wildlife, Narragansett, R. I.

Much In Common

The Japanese and U.S. scientists have been leaders in the multination study of

tropical Atlantic tunas begun 5 years ago. Since its inception in 1965, BCF TABL has researched tropical Atlantic tunas. By mid-1969, TABL had completed 27 cruises to study the ecology and biology of the 7 species of tuna native to Atlantic waters; the 'Shoyo Maru' has completed 4 Atlantic and many Pacific cruises on similar investigations. Both TABL and the Shimuzu laboratory have prepared and circulated volumes of scientific data on the tunas.

Atlantic Tuna Commission

The scientists discussed the newly established Atlantic Tuna Commission scheduled to open headquarters in Madrid, Spain, soon. The Convention that established the Commission was ratified in 1968 after the "Working Party on Tuna Stock Assessment"--set up by FAO--met for 4 days at TABL in August 1968 to discuss a plan of operation. Ten nations are members: Brazil, Canada, France, Ghana, Japan, Morocco, Portugal, South Africa, Spain, and the U.S. The Commission met for the first time at FAO, Rome, Dec. 1-7, 1969. The nations will work closely on a long-term examination of Atlantic tuna populations--toward the goal of conserving, yet exploiting to the fullest, these commercially valuable food fishes.

TABL & BCF Honored

During the Shoyo Maru's visit, Dr. Ueyanagi honored TABL and BCF on behalf of Japan by presenting TABL Director Carl J. Sindermann and Assistant Director Albert C. Jones with two objects of Japanese art--a lacquered serving platter and a figurine of Princess Michiko.

The vessel held open house on January 2 for members of the Miami marine-science complex.

17 U. S. FIRMS PARTICIPATE IN LONDON TRADE SHOW

BCF participated in the Hotelympia International Catering Exhibit, London, England, Jan. 6-15, for the third time. Seventeen U.S. firms displayed and promoted samples.

Sales of fishery products were about $203,000. These included orders for live and frozen eels, shrimp, and King crabmeat. Keen interest was shown in frozen crayfish products, King crab, Maine and Alaskan shrimp, fresh and frozen North Atlantic lobsters, canned Gulf shrimp, and tanner crab.

1969 WHALE SEASON YIELDS 108

The only U. S. whaling station, operated by Del Monte Fishing Company, ended its 1969 operation on December 5 because of bad weather and scarcity of whales. The 1969 season, which had opened about May 1, produced a catch of 108 animals. Included were 31 fin, 10 sei, and 67 sperm whales. The total also included 34 undersized or lactating sperm whales taken under a special scientific permit for studies by BCF's Marine Mammal Laboratory.

Gray Whales

Visual counts of gray whales passing Yankee Point, Calif., during the southward migration began in mid-December. Over 1,900 were counted by Jan. 21. Rough weather at peak of the run made counting difficult; counts probably were low. During the first week of January, up to 200 whales a day were counted.

LIVE CRABS HELD IN SEA-WATER SPRAY SYSTEM

A continuing problem in the Dungeness crab fishery is the cost of live-holding tanks on the boats, reports BCF's Seattle Technological Laboratory. The circulating seawater tanks, usually constructed of iron, corrode. They must be replaced frequently. The cost of replacement ranges from $1,000 to $5,000, depending on boat size.

Laboratory personnel say one possible solution is to eliminate the tank and store the crabs in the hold by "a sea-water spray system that provides the essential moisture, oxygen exchange, and temperature control to maintain the crabs healthy but quiescent." Estimates are that such a spray system could be installed on a 50-foot boat for about $500.

Lab Experiments

Experiments with sea-water spray for holding live Dungeness crabs aboard vessels were begun in Willapa Harbor, Washington. The large RSW holding tank was installed on the after deck of the M/V 'Ethel May,' a 52-foot crab boat. Hard-shelled crabs were taken from 60 pots to provide about 600 lbs. of crabs. They were loaded immediately into the tank when brought aboard vessel. To limit damage to crabs, the holding tank was flooded prior to loading operation. After all crabs had been loaded, the tank was drained and the spray system put into operation.

Poly-Vinyl Chloride Spray System

The spray system consists of pumping sea water through 3 spray nozzles attached to a 1-inch diameter poly-vinyl chloride pipe frame mounted inside holding tank. Water flows through the system at about 35 gallons per minute. The angle at which the water sprays from each nozzle is about 150°. The spray pattern is wide and flat; it is uniformly distributed over top layer of crabs.

Few Died

After 48 hours under the spray--and a total of about 55 hours out of the ocean--only 4 of over 300 crabs have died. If Dungeness crabs can be held this way for 3 or 4 days with a mortality of less than 5%, the experiment will be considered a success.

The operation, which will continue, is being watched closely by crab fishermen from California to Washington, reports the Seattle Technological Laboratory.

FISH-GUTTING MACHINES DESIGNED FOR FISHING VESSELS

Fish-gutting machines in the past have been too big and costly for any but the largest factory trawlers. Now two types of gutting machines have been developed for medium vessels. Their introduction may enable trawlers to carry smaller crews and handle their catch more quickly and efficiently.

BCF's 'Vacuum Eviscerator'

The 'vacuum eviscerator' was developed by BCF's Technological Laboratory in Gloucester, Mass. It is designed to handle 60 fish per minute, compared to manual rate of 16 fish per minute. The operator holds a fish (head first) against a nozzle and depresses a foot pedal. The gut is removed and the fish washed and flushed by the machine. The prototype system is not fully automatic, but a fully automatic system should evolve. It is estimated that a complete eviscerator will cost about $5,000.

'Shetland Gutter'

A second gutting machine is the "Shetland gutter," invented by a farmer. It is simple and sturdy. The British White Fish Authority sought to improve the basic design but was able to make only minor changes to components. Already in production, the Shetland gutter is designed for small draggers and handles 45 fish per minute. It costs less than $3,000 and can take fish up to 17 inches long. Later models will handle larger fish.

BCF EXPLORES PRAWN FISHING OFF SURINAM

In 1969, BCF's research vessel 'Oregon II' discovered commercial concentrations of giant scarlet prawns off Surinam, South America, in 350 to 450 fathoms. More recently, the vessel completed a followup cruise in the same general area for the same species. She fished with large shrimp trawls.

During 13 days of fishing, 23 of 30 sets were considered successful, producing over 1,500 pounds of scarlet prawn tails (7 to 30 count).

These prawns are a desirable commercial commodity. BCF's efforts will assist in development of a fishery.

INTEREST RATE ON FISHERY LOANS IS RAISED

BCF announced on Jan. 30, 1970, that interest charged on Bureau-approved fishery loans has been raised from $7\frac{1}{2}\%$ to 8%.

Philip M. Roedel, Bureau director, said that by law the interest rate is based on the average yield of Government obligations with maturities of 7 years. On Dec. 31, 1969, this yield increased to $7\frac{5}{8}\%$, necessitating a corresponding increase in the interest rate on fishery loans.

How Loans Used

Fishery loans are direct Government loans to owners of fishing vessels. The loans may be used to finance and refinance the purchase, construction, equipping, maintenance, repair, or operation of commercial fishing vessels or gear--when funds are not otherwise available on reasonable terms.

NEARLY $6 MILLION IN COMMERCIAL FISHERIES AID AVAILABLE TO STATES

Commercial fisheries grants in aid of $5,950,000 have been made available to the States, Commonwealth of Puerto Rico, Virgin Islands, Guam, and American Samoa. This was announced Jan. 27, 1970, by Assistant Secretary of the Interior Leslie L. Glasgow.

The funds partially reimburse the recipients for completed work on commercial fishery projects. The funds are used on a cost-sharing basis for research, development, construction, and improvement of facilities and vessels designed to benefit the Nation's commercial fisheries. Projects are selected, designed, and carried out by the States, with up to 75% of cost financed by Federal funds.

Nearly $28 Million Since 1965

Since 1965, nearly $28 million in Federal funds have been made available for 348 commercial fisheries projects under two Acts: Commercial Fisheries Research and Development Act of 1964 (P.L. 88-309) and Anadromous Fish Act of 1965 (P.L. 89-304).

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SHRIMP-FISHERMEN TRAINING SUPPORTED BY LABOR DEPT.

Because there is a shortage of shrimp fishermen in the U.S., the Department of Labor is supporting a program to train shrimpers for the Gulf Coast. This was reported by the Department's magazine 'Manpower' in Dec. 1969.

Under a contract awarded to the Freeport (Texas) Shrimp Assoc., a consortium of boat owners is sponsoring the program. The owners place qualified recruits on board their vessels during the on-the-job phase. Since training began in Feb. 1969, 80 men have taken jobs and gone to sea; 70 more will be trained. The total cost will be more than $471,000. Training is conducted by Fitzgerald Laboratories, Inc., Annapolis, Md., which has established in Freeport a dockside training center.

The Program

Groups of 10 trainees certified by the Texas Employment Commission begin training at 2-week intervals. The first phase is 8 weeks of on-shore instruction; then 44 weeks of on-the-job training aboard shrimp boats.

The training is divided into 3 parts: 1) Fundamentals: seamanship, oceanography, navigation, communications, engine maintenance, trawls and rigging, net making and repair. 2) Practical experience in workshops at the center and on board a training vessel staffed by instructors. 3) Student signs on a fishing trawler. There he will get his "sea legs" and the experience to make him a competent shrimper.

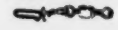
Trainees Counseled

The program includes job adjustment and counseling to help trainees with discipline, adjustment to the sea, social skills, budgeting. The center uses industrial psychologists and job counselors because many trainees have little schooling or job experience.

Paid During Training & After

Trainees are paid at least $1.60 an hour during training, and $5,000 annually afterward.

A typical off-coast vessel with a 3-man crew may be at sea 4 to 20 days.



NEW FISH-LOCATING TECHNIQUES

In some fisheries, as much as 85% of a vessel's operating time is spent locating fish. Reducing searching time as much as possible is very important. Experiments with airborne and/or spaceborne equipment have been promising. A qualified observer can distinguish many species of pelagic fish on the basis of color. These color differences are used by spotter pilots of the commercial fishing industry to locate and identify fish.

The experienced spotter also uses other features: the presence of fish oil films, diving birds, ripples and, sometimes, a churning of surface waters. Airborne and spaceborne sensors, which are better than the human eye in many important respects, may be used to locate and identify surface and near-surface fish stocks.

Measure Color Patterns

The distinctive color of certain species suggests that spectral measurements of the color patterns with analytical equipment may be used to locate and identify fish schools in their natural environment under certain conditions. During September 1968, BCF's Pascagoula Base (Miss.) obtained spectral-reflectance measurements of 15 schooling species in the northern Gulf of Mexico. Measurements were made on single fish, fish in small groups, and fish in schools inside impoundments using a water-color spectrometer. Results of these preliminary measurements indicated the idea has merit; equipment to continue studies in this area is available.

To Study Captive Schools

During the coming months, observations will be made of the color patterns of some commercially important species in their natural environment. These observations will be made on captive schools under a wide range of known (monitored) environmental conditions of sea-state, lighting conditions, and water turbidity. The results will determine the feasibility of an airborne or spaceborne operational system to locate and identify fish schools from observations and automatic analysis of color patterns.

Light Sensors

Another promising approach to locating and identifying pelagic fish is the low-level light sensors, such as image intensifiers. These detect the bioluminescence, or "fire" as fishermen call it, associated with most schools. The Spanish mackerel fishery, which yields an annual catch of 7 to 8 million pounds, illustrates the potential application of this method. In Florida, this fishery is carried on chiefly with gill nets and haul seines at night. The fish are sighted by "fire" in the water. This "fire" results from the movement of fish schools that cause luminescent organisms to glow momentarily. The bodies of rapidly swimming fish are outlined with light; each leaves a trail of fire as it moves. Large schools of mackerel, 5 to 10 tons, are identified by individual flashes within a larger glowing sphere of bioluminescence. The "fire" can be seen best with the naked eye on moonless nights; however, fishing is also done on cloudy nights.

A series of tests has been conducted by BCF Pascagoula from Coast Guard helicopters, fixed-wing aircraft, a stationary oceanographic platform, and surface vessels using a television-image intensifier system. They amplify 40,000 times the ambient light or, in this case, the bioluminescence.

This system has been used to observe fish schools, individual fish, SCUBA divers, and objects towed at subsurface depths in water masses containing both low and high concentrations of luminescing organisms. Off Florida's west coast, imagery was obtained of thread-herring schools at night from altitudes of 500 to 5,000 feet. Test results strongly suggest that low-level light sensors may be used effectively from high altitudes to locate, and possibly identify, pelagic fish stocks over large oceanic area.

The remote sensing system expected to evolve will have daytime and nighttime sensing capabilities. It will scan wide areas at high speeds--and provide real time data on the location, quantity, and species of pelagic fish stocks with much accuracy.

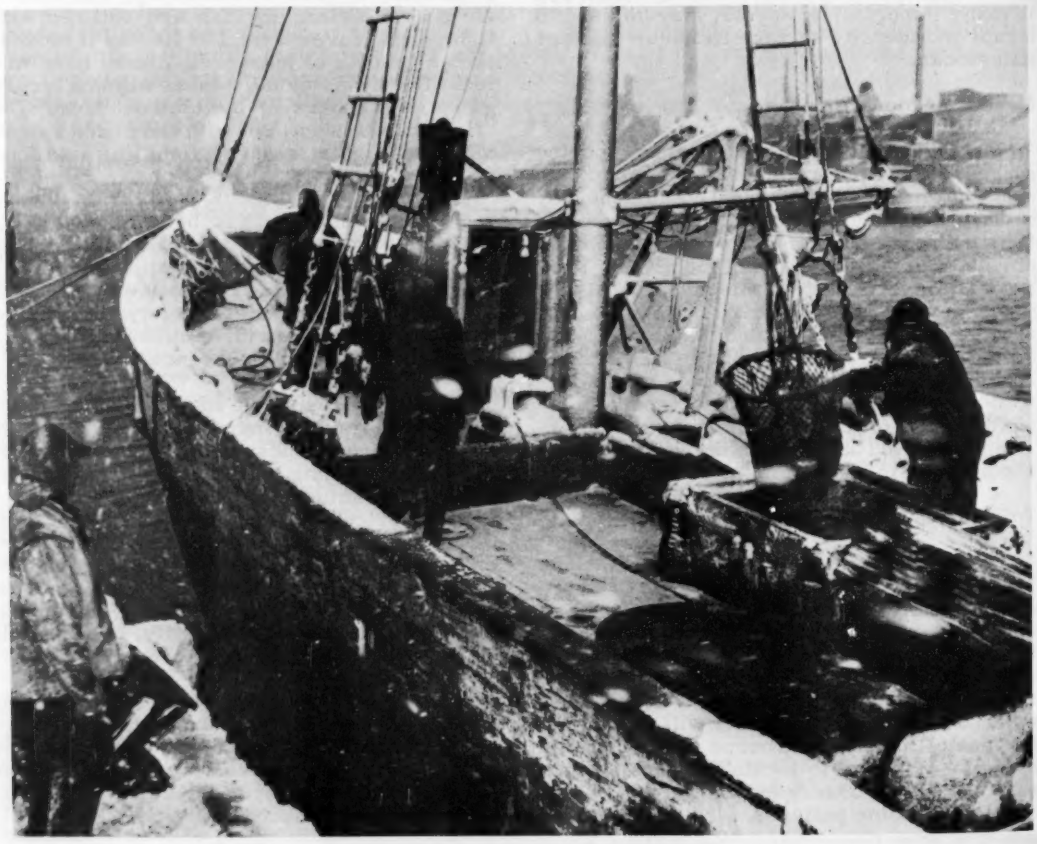
DECADE OF NORTH ATLANTIC FISHING REVIEWED BY BCF

BCF Gloucester (Mass.) provides this review of a decade of fishing in the North Atlantic region:

Generally, the condition of domestic fisheries in the region is not good, but there are some bright spots. There is room for optimism in U.S. international negotiations. We appear to be approaching the day when country quotas will become a reality in the Northwest Atlantic. It is imperative that our research efforts be maintained at a level that will give our international experts the facts they need at the conference table.

Foreign Vessels Appear

Foremost in many minds are the foreign fisheries off U.S. shores. The 1960s began with Soviet exploratory vessels appearing off New England. These were followed by large fleets of several nations. At first, these fleets caught herring. But in 1969 the Soviets began taking substantial quantities of silver hake.



Unloading fish during a snow storm in Gloucester, Mass. (Photo: Robert K. Brigham)

By 1965 the Soviet catch of silver hake was 7 times the U.S. landing of this major food species.

Haddock Catch Declines

The 1963 year-class of haddock was one of the largest on record. In 1965 and 1966, over 430,000 metric tons of haddock were taken by the Soviets, Canadians, and the U.S. The landings in each of these years were about double the average annual landings by all nations in previous years. Since 1963, there has not been a successful year-class of haddock. In 1969, U.S. landings were down to about 20,000 metric tons. The Soviet and other European fleets are no longer interested in haddock. They are continuing their efforts on silver hake, herring, and other industrial species.

Silver Hake Declines

At the end of the decade, landings of both haddock and silver hake were less than 50% of 1960 landings. In recent years, these species have been the backbone of Boston and Gloucester fisheries. Landings of ocean perch, the leading New England food fish in 1960, are down 60%, and scallop landings even more.

New Bedford Still No. 2

The sea-scallop situation has adversely affected New Bedford, but it has not ousted that port from second position in the Nation in value of fishery landings. Largely responsible for New Bedford's position is the yellowtail fishery. Strong broods have appeared year after year. Landings have held up well with an annual value 3 times greater than 10 years ago. However, this fishery is being exploited at about the maximum it can sustain, and there is always the possibility of foreign competition.

Menhaden Industry Grim

To the south of New England, the situation in the menhaden industry is grim. Some plants are idle; others have been operating at a minimum.

Oyster Industry

Although the oyster industry in Connecticut and on Long Island is encouraged by excellent sets in 1966 and 1968, recovery from the MSX disaster in Delaware and Chesapeake Bay has been slow. However, there are some signs of improvement.

Alternate Resources

BCF Gloucester hopes that such alternate resources as sea herring and pollock will be utilized more fully by U.S. vessels. The Soviets, Poles, and Germans are still harvesting vast quantities of herring off shore. Recently, East and West German vessels have been taking substantial numbers of pollock which, BCF Gloucester believes, will serve as an excellent substitute for haddock.

Clam Fisheries

The three existing clam fisheries of the North Atlantic region continue to thrive. Surf clam and soft clam production here doubled since the beginning of the decade. The blue crab industry has had its usual fluctuations in supply--but the greatest year-class in history is now entering the fishery in Chesapeake Bay.

New Fisheries

Several new fisheries have considerable potential in the North Atlantic. The offshore lobster trawl fishery has developed largely during the past 10 years. Landings now exceed five million pounds annually. Interest in the offshore pot fishery for lobsters is also increasing. Two latent resources worth watching are the ocean quahog and red crab; the former is already being landed in small quantities.

Shrimp Promising

One of the most encouraging developments of the decade is the northern shrimp fishery. Annual landings have gone from virtually nothing to thirty million pounds during the past 10 years. This fishery started in Maine and is now bolstering the Gloucester economy, which was damaged badly by the drop in landings of ocean perch and silver hake.

BCF Gloucester concludes: "While we cannot look to the seventies without some apprehension, we do believe that if our industry can be assured proper access to the resources off our shores, brighter days lie ahead."

PACIFIC SAURY: LARGE LATENT RESOURCE

The Pacific saury (Cololabis saira) is a slender teleost resembling, superficially, a wingless flying fish. It is one of three species of the family Scomberesocidae. Adult saury, 28-32 cm. long, are expectionally firm-fleshed. The meat is oily.

The saury is highly regarded as a fresh and canned product in Japan and the Soviet Union. Large amounts also are frozen for use as bait in tuna longlining.

3 Stocks

The Pacific Ocean contains three main stocks: The Asian is located off the Soviet Union, Korea, and Japan; the central Pacific stock surrounds the Hawaiian Islands; and the eastern Pacific stock occupies coastal waters from Baja California to northern British Columbia. Although the three stocks generally are considered geographically isolated, some intermixing may occur.

Large Resource Off California

U.S. scientists who have conducted egg and larval studies off California report a very large saury resource. Soviet surveys off the U.S. west coast showed saury in coastal region 50-150 miles wide and 450 miles long between northern California and Washington.

Albacore fishermen off Oregon often observe schools of saury miles wide and up to 20 miles long. During September 1967, BCF's research vessel, 'John N. Cobb,' encountered a school covering a 3-4-mile area 30 miles offshore near Destruction Island, Washington.

Estimates of Stock

Minimum estimates of the eastern Pacific saury's standing stock range between 450,000 and 800,000 tons. Some researchers feel the figures may be 4-5 times greater. The stock is believed at least as large--and possibly several times as large--as the Pacific hake population.

Japan & USSR Fishery

Both Japan and the Soviet Union fish the Asian Pacific saury on a large commercial scale. Nearly 1,000 vessels support the Japanese saury industry. Although the size of the Soviet saury fleet is unknown, it is believed comparable to the Japanese fleet.

The Japanese catch was 210,000 tons in 1967 and about 150,000 tons in 1968. In recent years, Japanese catches have exceeded 500,000 tons. In 1968, near Tokyo, fishermen sold large saury to fresh-fish market for $375-958 a short ton. The tuna longline industry was paying up to $500 a ton (25 cents a pound) for bait saury.

Potential for U.S.

Saury has been sold in the U.S. only in very isolated instances, so its potential price in U.S. is unknown. Assuming comparable prices with average Japanese markets, the

exvessel value of potential annual harvest of eastern Pacific saury is at least $100 million. The value of saury for Fish Protein Concentrate (FPC) would also be large after procedures for using this species were developed. Possibly, saury exports to Japan would be very profitable because Asian saury catches have been declining in recent years. The export of bait saury to American Samoa for sale to foreign tuna longline vessels might be profitable.

Soviet Interest

Foreign interest in the eastern Pacific saury stock is obvious. The Soviets have conducted at least two extensive surveys off U.S. U.S. fishing vessels have reported a few Soviet vessels fishing saury off U.S., probably exploratory. Soviet publications indicate great interest in this resource and report Soviet intentions for a commercial fishery.

The Japanese realize the potential of this resource, but they have not investigated it as much as the Soviets.

Obstacles to U.S. Fishery

There are problems in developing a U.S. saury fishing industry. The harvesting methods of Japanese and Soviet vessels differ completely from U.S. methods; they require considerable manpower. Either foreign technology must be modified to U.S. needs--or completely new harvesting methods must be developed. If the former, manpower requirements must be greatly reduced by mechanization to make saury fishing profitable in the U.S. Many U.S. vessels that would be suitable fish other species between August and December, when saury are most available. U.S. markets must be developed, although a large potential export market exists.

Seattle Research

BCF's Seattle Exploratory Fishing and Gear Research Base has conducted preliminary research on saury and plans to expand its program. One exploratory cruise has been completed that provides background for a larger resource-assessment effort.

Much information has been acquired on Japanese and Soviet fishing methods, and plans are being developed to adapt the Japanese technique to U.S. needs and capabilities. Alternate fishing systems, which would be less labor intensive, also are being considered.

CATFISH FARMING IN 1969

BCF Ann Arbor, Mich., and the Bureau of Sport Fisheries & Wildlife laboratories in Stuttgart, Ark., cooperated in reporting the 1969 catfish story. Here are highlights:

The U.S. catfish farming industry received much publicity in 1969, but it is "not all wine and roses. There are trouble spots due to growing pains: Product quality has not always been up to par; market expansion has been limited by inadequate product portion control and high prices; processing plants have not been able to get enough fish to operate efficiently; many producers have yet to show a profit; catfish inventories are building up in ponds; disease incidence is increasing--harvesting and handling techniques are still relatively primitive; and other problems."

Catfish farming acreage continues to expand. Over 40,000 acres across the southern half of the U.S. were under catfish culture in 1969. Around 2,000 of these were devoted to fingerling production.

Close to 1,300 persons and firms are in farm catfish culture in the U.S. (excluding California). The average size of catfish farms (water impoundments) in the South-Central States is about 38 acres, but the majority range between 10 and 30 acres.

Probably not over 20,000 acres were harvested. Possibly 23 to 28 million pounds were produced. These are only estimates--because no reliable data-gathering system exists.

Catfish Use

Local markets (restaurants, retail, live marketing) remained the major market.

Live fish haulers paced prices in spring and early summer. They paid up to 50 cents per pound and took an estimated 2-3 million pounds.

Around 2 million pounds were processed in plants in Arkansas and Mississippi--only 10-15% of capacity. By the time most plants became operable in late spring, competition from live fish haulers drove prices out of their reach and forced them to close over the summer. To resume operations in early fall, processors had to pay 40 cents a pound.

New Outlets

"Fast service restaurants featuring catfish sprang up in several South-Central cities--many with franchise or chain expansion plans. Lack of catfish supplies, inexperience, under-financing, competition, and other factors forced abandonment or postponement of many such plans. The surviving restaurants are prime markets for processed farm catfish and are expected to expand. However, the picture is clouded by special interests of stock promoters of franchise operations."

Supermarkets More Important

Supermarkets became increasingly important as market outlets for fresh and frozen farm catfish. Retail outlets were a major factor in reducing inventories of frozen catfish products not acceptable to restaurants. "Restaurant markets are highly sensitive to product size and form, whereas retail markets are able to accommodate more variation in the product."

Imports

Imports of catfish increased to around 4 million pounds in 1969; 85% came from Brazil, 14% from Mexico. Imports compete successfully in many restaurants because they are much cheaper. "No adverse consumer reaction has been noted."

California Debuts

California now has about 1,500 acres in production, mostly in small ponds. "Climate, water, markets, and increasing interest point to California as a potential major producing and market area for farm catfish."

SOME MAJOR PROBLEMS

Water Quality: The need for adequate supplies of fresh water has been emphasized repeatedly. During summer 1969, numerous farmers lost fish because they were unable to maintain good water conditions. Losses due to oxygen depletion often could have been prevented had fresh water been available in quantity.

Disease: The incidence of bacterial infections was very high. This reflected the re-

lationship of poor water conditions to disease outbreaks.

Agriculture Department's Soil Conservation Service suggested a 13 gpm per acre figure for well capacity. This represents "the absolute minimum a farmer should consider when planning his water system."

Disease control: The incubation period for Aeromonas liquefaciens infections in channel catfish is 10-14 days. Farmers should expect outbreaks of bacterial diseases 10-14 days after any stress. "Parasites, handling, or low oxygen stresses may be involved in disease occurrence. Fish should not be handled for at least two weeks if they have undergone low oxygen stress."

Ichthyophthirius or "ich" disease was observed in fingerlings on several catfish farms as of Oct. 1, 1969, about 6 weeks earlier than usual. "Farmers are urged to use preventive measures in ponds where fingerling catfish are being reared."

Harvesting

Harvesting is still "a rather haphazard procedure." Haul seining has vastly improved over the past few years, but it is still a "cumbersome, time consuming, and often expensive harvesting method." Most producers feel they cannot afford their own equipment and must rely on outside harvesting crews and facilities. The latter have been acquired by most large producers and processors.

The development of more efficient holding, handling, and sorting methods is proceeding slowly. In-line weighing scales now are commonly used while fish are being lifted from nets to hauling conveyances. Mechanical grading devices and catch estimators are under development at the Kelso Gear Research facility, Arkansas.

Lack of adequate catfish supplies and the continuity of deliveries were critical to processing. They caused processing costs to increase up to 20 cents a pound--a cost that eliminates profit margins. Some processors are likely to face this problem again in 1970.

Quality

The catfish image as a superior product was hurt in summer 1969 by reports of poor quality. Maintenance of high quality during processing and storage for "wholesomeness, taste, product form and weight is a major problem facing processors." Off flavor occurred in some catfish traceable to pond sources. Freezer burn (dehydration) was noted in catfish products held in cold storage improperly packaged or glazed. Markets rejected these.

Sanitation measures in some processing plants have been inadequate.

Portions and Packaging

Non-conformance with portion control and packaging requirements of certain market outlets, particularly restaurants, produced a frozen inventory buildup of over one-half million pounds by October 1969. This inventory was being reduced primarily by sales to supermarkets.

Lack of knowledge of the size of markets and the requirements of individual markets limits the ability of producers and processors to plan marketing programs and to choose market alternatives.

Resistance by institution buyers to wholesale prices of over 90 cents per pound for frozen farm catfish developed.

Fast service restaurants cannot compete at these wholesale prices. So many turned to imported products.

Wide-scale consumer reaction to retail prices of $1.29 to $1.39 per pound retail is largely untested. There are indications of resistance at the higher price.

Production Costs

Current production costs of 28 to 30 cents or more per pound at farm level is too high to permit processing and marketing to large users--restaurant chains and convenience food processors.

THE CRAWFISH INDUSTRY

A report by BCF's Biological Laboratory, Galveston, Texas, indicates that most of the U.S. crawfish production is in Louisiana. In recent years, annual production in Louisiana has fluctuated from 200,000 to 10,000,000 pounds. The resource is valued at $4 million annually. Crawfish are harvested from natural waters, rice fields, and impoundments. Outside Louisiana, a large species is harvested in Oregon and shipped to west coast cities as "short lobsters"; only $7,000 worth are sold annually.

In Louisiana, the bulk of wild crawfish come from Atchafalaya Basin, where more than 2 million pounds may be harvested in a good year. Most crawfish are caught in chicken wire crawfish cages. It is not unusual for trappers to take 200 or more pounds per day.

Louisiana also produces 3 million pounds of crawfish on 6,000 acres of crawfish farms.

There are four genera and 29 species of crawfish in Louisiana. Only two large species, red swamp crawfish (Procambarus clarkii) and white river crawfish (Procambarus blandingi acutus), are taken for commercial markets. Smaller species are used as bait by sports fishermen.

The species harvested in Oregon is Pacifasticus leniusculus.

Biology

Adults inhabit open waters in winter and spring. About July 1, females dig burrows 24 to 36 inches deep in dry areas. If fields are still flooded, they burrow in levees, high spots in fields, or migrate to adjacent fields. Egg laying begins about September 1. Female fertilizes eggs from sperm receptacle placed in May. Eggs are deposited in balls on swimming legs. Red swamp crawfish produce up to 700 young in 14-21 days. White river crawfish produce 200-400 young in 18 to 29 days. While September and October appear to be the peak hatching time, adults have been observed with young every month of the year.

If water is available, crawfish will come out of their holes about October 1 to rear and scatter their young. The minimum size for edible crawfish is 15 to 20 grams. It takes about 210 days for late-summer or fall-hatched crawfish to reach this size.

Crawfish feed best at temperatures of 65° to 80° F.; little feeding occurs below 45° or above 90° F. Crawfish will eat animal matter in small amounts--in the form of insect larvae, etc.--but they are not active predators; dead and living vegetation makes up the bulk of their diet. They are cannibalistic: females will eat a portion of their brood when confined in small areas without food.

Crawfish can come to the surface and breathe during periods of low oxygen content.

Males become 10 to 35 percent heavier than females at maturity. This difference is caused by differences in size of chelae and is not reflected in tail meats. (A chela is the pincerlike organ or claw borne by certain limbs of crustaceans and arachnids.) Larger individuals have a lesser percentage of tail meats than do smaller crawfish.

Fish are the worst predators of crawfish, but racoons, ibises, herons, boat-tailed grackles, sea gulls, legless salamanders, and predacious water beetles are all known to eat crawfish.

Farm Operations

Some farmers rear crawfish as their main crop and manage impoundments either for this purpose alone--or with possibility of developing crops of bull frogs and turtles. Others raise crawfish in rice fields, or in rotation

with rice; crawfish are a winter crop and rice a summer crop.

It is not necessary to stock established fields. New fields are stocked in May. Red swamp crawfish are stocked at 10-15 pounds per acre. White river crawfish are more suited for deep-water impoundment than rice fields. This species is stocked at 25-30 pounds per acre. A farmer should have a constant source of water and be able to control water levels. Water depths of 2 to $2\frac{1}{2}$ feet are ample. Crawfish can be grown in as little as 6 inches of water, but the deeper the water the larger the crawfish will grow before attaining maturity. In addition, shallow water encourages predation. Water with a minimum of 17 p.p.m. total hardness (calcium and magnesium) is required for survival of the young.

Fertilizer requirements are the same as those for raising any crop requiring a high calcium fertilizer in the same type soil. Very acid soils require liming--1 ton per acre lasts several years.

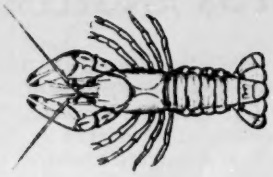
Rotenone is used to control predators remaining in pot holes, etc., during draw-down.

Not much is known of the effects of pesticides and herbicides on crawfish; however, this information is particularly important where crawfish are grown with rice. The herbicide, potassium azide, was found to be toxic to crawfish at concentrations above 0.25 p.p.m. Fields treated at 2.0 p.p.m. had lost their toxicity after 10 days. Sodium azide is more toxic than potassium azide.

One successful procedure for field management was given by Carl H. Thomas in 1965:

Time		Practice
Early spring	-	Field plowed
May 1st*	-	Field replowed and rice planted
May 15-Aug. 1	-	Field flooded--growing rice
Aug. 1*	-	Water drained off rice
Aug. 15*	-	Rice harvested
Sept. 1-Nov. 1*	-	Field reflooded
Sept. 1-June 30	-	Field remains flooded
Dec.-Mar.*	-	Crawfish harvested

*Dates approximate, may vary 10-15 days.



Contracting the Harvest

Some farmers contract out harvesting for a set fee per pound of crawfish harvested, some fish for themselves, and others open land up to the public to fish at a price per pound. Most harvesting is with traps or crawfish nets. Standard cylinder-type or funnel entrance traps are most common. Traps are baited with catfish heads, gizzard shad, buffalo-carp, and beef melt. Well-baited traps will catch $\frac{3}{4}$ to 1 pound in 6 to 8 hours. They are usually checked in the morning and evening.

Yields from Good Pond

Annual yields from a good pond vary from 400 to 1,000 pounds per acre. Experimental production with supplemental feeding yielded 1,200 pounds per acre. Individuals harvested in December to early February are large, averaging 10 to 11 per pound. Average size then decreases as young of the year enter the catch.

Early season retail prices start at 35¢ to 50¢ per pound and decline gradually to 12¢ to 15¢. Only the tail meat and fat (hepatopancreas) are used. Tail meat is placed in plastic bags and packed in ice along with small cartons of fat. The peeled tail meat sells for $2 to $3.50 per pound.

The State of Louisiana and local institutions are conducting biological research on crawfish. Also underway are studies of predator control, levee maintenance, pond engineering, and optimum soil determination.

There seems to be little need for Federal action along these lines, says the BCF Galveston Biological Laboratory. The need is for advertising, market development, and food technology studies to develop recipes and processing techniques.

LOS ANGELES: FABULOUS FOOD FUNNEL

The Los Angeles District of the U.S. Food and Drug Administration (FDA) is often called the 'Southland.' It includes Arizona, California's 9 southernmost counties, Nevada's Clark County, and American Samoa.

FDA says of Southland:

"We have some of almost every food and drug industry; much of most specialties, and practically all of certain ones; and more quackery than we like to admit.

". . .Imports arrive from all over the world at Southland seaports. We receive 58,000 formal entries of food products a year, representing 12 percent of the United States total. These include basic food commodities produced in Europe and South America, food seeds from the Middle East, copra and spices from the South Pacific, and both basic and exotic foods from the Orient. A total of 190,000 tons of tuna, comprising half of the tonnage handled by the United States and all its possessions, was landed in 1967 to supply the southern California tuna canning industry. Much of this tuna originates in Japan, South America, and other foreign fisheries. This import workload is handled through a working agreement with the Cannery Inspection Section of the California State Bureau of Food and Drug. This agency maintains continuous inspection in tuna canneries, examining every fish that enters the cannery, and rejecting those that fail to meet standards of quality and wholesomeness. This agreement of many years standing is an excellent example of Federal-State cooperation that protects consumers without duplication of effort."

Fig. 2 - FDA Inspector (R.) makes organoleptic (smell, sight) examination of tuna in a Terminal Island tuna-processing plant.

Fig. 1 - The harbor at Terminal Island, Los Angeles. A tuna fleet docks here.

Fig. 3 - Watching the unloading of raw kelp--processed for seasonings and animal food at San Pedro, Calif.

Fig. 4 - In San Diego abalone-processing plant, an inspector watches worker remove abalone from shell in first step of processing. Later, the abalones are cut into steaks. (All photos FDA)

GREAT LAKES FACE ENVIRONMENTAL CRISIS

On Sept. 29-30, 1969, the Subcommittee on Energy, Natural Resources, and the Environment of the Senate Committee on Commerce heard testimony on the effects of pesticides on sports and commercial fishermen. William F. Carbine, BCF Regional Director, Ann Arbor, Mich., stressed "the environmental crisis that we face here in the Great Lakes."

Nearly all of Mr. Carbine's testimony follows:

Although the Great Lakes constitute the largest and most valuable fresh water resource of the world, their environmental quality has been deteriorating at an increasingly rapid rate in recent years. The biological and recreational values of the lakes have suffered most from the environmental changes that have taken place. These values may continue to decline even under proposed pollution abatement measures as the lakes will continue to be enriched at a rapid rate. Such enrichment causes the fouling of shallow areas and beaches with the obnoxious algae cladophora and creates conditions that are increasingly unfavorable for the desirable species.

The value of the water of the Great Lakes for municipal and industrial use has not suffered greatly yet, but may be seriously affected if concerted basinwide action is not taken immediately to stem the tide of environmental deterioration which continues to threaten all uses.

The municipal and industrial uses and value of the Great Lakes are enormous, but the total worth of the Great Lakes includes many other uses of major and increasing value and importance to the Nation's economy. The fishery resources of the Great Lakes provides annually over 80 million pounds of food fish for the United States and Canada and more than 50 million pounds of industrial fish. The value of the recreational industry based on the fishery resource has increased tremendously in the past decade and its total worth is incalculable. Other recreational uses of the Great Lakes such as boating, swimming, and related activities are accelerating greatly.

Areas of the Great Lakes that have been influenced most by the increases in the human population and industry have shown marked changes in fish stocks. The confined areas of southern Green Bay on Lake Michigan and Saginaw Bay on Lake Huron, and the Detroit River and western Lake Erie have long received the wastes of growing populations and expanding industry.

The early superficial changes in water quality of these areas provoked pollution surveys that in some instances have brought about improvement in water quality for domestic use, but highly nutrient wastes that continued to enter these areas eventually created an overenriched environment that destroyed desirable aquatic life. As this occurred, there was an accompanying gradual, almost unnoticed, retreat of highly prized species such as lake trout, whitefish, lake herring, and walleye, from the inner areas of the bays, the Detroit River, and western Lake Erie. These fish were replaced by increasing populations of alewives, carp, smelt, and stunted yellow perch.

The most recent and alarming aspect of the environmental crisis of the Great Lakes has been the appearance of concentrations of pesticides that seriously threaten the value of even the more desirable fish, and may contribute even more to the rampant environmental instability already triggered by enrichment.

Fish and other aquatic organisms have shown a remarkable capability to concentrate chlorinated hydrocarbon insecticides contained in their food and directly from water. Monitoring studies conducted by the Bureau's Great Lakes Fishery Laboratory, Ann Arbor, over the past 3-year period indicates that on the basis of DDT—this also included DDD and DDE—and dieldrin levels in whole fish, the rank of the Great Lakes in order of highest to lowest concentrations of insecticides is: Michigan, Huron, Ontario, Erie, and Superior.

Insecticide levels calculated on the whole fish basis show a marked difference from species to species; generally, a positive correlation appears between fat content and insecticide concentrations. For any given species, DDT and dieldrin levels appear to increase with an increase in the size of fish.

Laboratory investigations have shown that levels of these insecticides in water, in the low parts per billion range, can be toxic to adult fish. Evidence also exists that levels in the low parts per trillion range, although not toxic to adult fish, may affect reproduction.

Pesticides have already caused serious concern about management and production of lake trout and coho salmon—two of the key species in a program to reduce the problems caused by the alewives and enhance fishery values of the Great Lakes. There have been excessive mortalities of coho salmon eggs that have been attributed to pesticide contamination, and high levels of DDT and dieldrin in large coho and lake trout have raised questions by the Food and Drug Administration about the establishment of safe levels for human consumption.

The fish stocks of the Great Lakes have undergone progressive deterioration for more than a century. In the mid-1800's desirable species abounded in all of the Great Lakes, but subsequently all have been reduced greatly or virtually eliminated at various times throughout the Great Lakes. At no time in the history has there been an overall concerted interstate or international effort to reverse these unfavorable trends.

Once the Atlantic salmon, lake trout, whitefish species, and pike perch species comprised 80 to 90 percent of the total production of all of the lakes, but these species that contributed so greatly to the early fishery now usually constitute, where they are still present, less than 5 percent of the fish taken from the lakes.

The history of the Great Lakes shows a sequence of collapses of stocks without subsequent recovery. The Atlantic salmon inhabited only Lake Ontario where it became virtually extinct by 1880 which was attributed by many to the despoilment of its spawning streams. The whitefish all but disappeared from the St. Clair-Detroit River area by 1900 where pollution was intense and unchecked. The lake herring populations collapsed successively in various lakes between the 1920's and present as a result of intensive fishing, enrichment, and competition with the introduced alewife and smelt which have thrived in the richer environments of the lakes.

Blue pike and walleye have declined greatly or disappeared in the past two decades due to enrichment in Lakes Erie and Ontario, and Saginaw and Green Bays, or sea lamprey predation in other areas. The sea lamprey was the major factor in the decline of lake trout and whitefish in the upper lakes—Superior, Michigan, Huron—since the 1940's, but enrichment appears to be the primary factor for the near disappearance of these species in the lower lakes—Erie and Ontario.

As desirable species have been reduced, there have been population explosions of less desirable species at various times throughout the Great Lakes. Perhaps the most obnoxious and destructive of these has been the alewife which was introduced accidentally in Lake Ontario about 1870. Subsequently, it spread throughout the Great Lakes where under favorable conditions, it has undergone population explosions in Lakes Ontario, Huron, and Michigan, and has caused great distress by undergoing massive spring dieoffs, clogging municipal and industrial water intakes, and reducing greatly or eliminating all of the more productive and stable small species that provided food for preferred large predators such as lake trout and coho salmon.

Other low-value new species that have become widely distributed and very abundant are the carp and smelt. Carp were introduced in the late 1800's and during this century have been extremely abundant and have dominated enriched shallower areas of the Great Lakes. Although carp and smelt are not fished intensively, they rank fourth and fifth in pounds of fish taken from the lakes.

Smelt were introduced into a tributary of Lake Michigan in the early 1900's and have subsequently spread to all of the Great Lakes where they become extremely abundant at various times in the richest areas of the Great Lakes such as Green and Saginaw Bays and Lake Erie. Smelt have contributed heavily to catches, but have also been competitive to the detriment of the more stable and desirable exotic species.

Not all unfavorable population explosions as desirable species declined have involved exotic species. In Lake Erie the gizzard shad increased sharply when accelerated enrichment was first noted in the 1950's, and caused distressing problems and dieoffs. Then, the sheepshead increased to dominate the lake in the 1960's and now holds a competitive advantage that makes difficult the establishment of more desirable species.

The greatest current fishery problems are the great abundance of undesirable species and the extreme instability of the fish stocks due to natural vacillations accompanying population explosions and the continuing accelerated enrichment.

Safeguarding and perpetuating the Great Lakes fishery resource is a major responsibility of the U.S. Department of the Interior's Bureau of Commercial Fisheries. Any practice or series of events which threatens the abundance of fish or a useful and productive balance of fish species is of primary concern to us.

Scientists of the Bureau of Commercial Fisheries have been working with the fisheries of the Great Lakes and their environment over

a period of almost 50 years. The Bureau has been in a particularly advantageous position to observe the process of change that has been taking place in this—the largest complex of freshwater resources in the world. We were the first to direct public attention to the now well-publicized deterioration of Lake Erie.

Bureau scientists have found that water quality is detrimental to fish long before the more obvious issues of human safety and welfare are threatened. Before the public is aroused valuable fisheries and the waters that produce them are lost or so deteriorated that trends cannot be reversed or great effort and expense are necessary for rehabilitation.

We urge, therefore, a broad concept of environmental quality and pollution; a definition, not necessarily restricted to bacterial counts, excesses of dissolved solids, gross deficiencies in dissolved oxygen or easily detectable changes in bottom fauna composition. We urge the establishment of environmental quality standards that have prevention of pollution as a goal; not a set of limits that will define the degree of deterioration to be tolerated before action is taken to avert a national disgrace.

Experience has taught us that, frequently, troubles within one portion of this vast drainage have their origins in other, often remote, portions. We must become aware and remain cognizant of the occurrences in the Great Lakes that may threaten any portion of fish and wildlife. We must also strive to develop means of restoring fishes that already have become victims of situations created by the carelessness, greed, and shortsighted planning of parts of our society.

There should be close surveillance of any actions that might aggravate the already deplorable situation that has been developing in the Great Lakes drainage. Unless the practices which have induced these conditions are stopped and the trends toward further deterioration are reversed, the Great Lakes eventually will become the world's largest, but least valuable freshwater resource.

This concludes my formal statement as such. I would, however, like to make a few additional comments relative to the pesticide problem. Although the announced purpose of these field hearings is to consider the effects of pesticides on sport and commercial fisheries, we felt it appropriate that your subcommittee be provided a general review of the environmental deterioration that is taking place in the Great Lakes basin. Pesticide pollution is just one of the many complex influences which are threatening the usefulness of the Great Lakes. It is imperative that we attack these environmental problems on a broad front in a coordinated fashion.

More specifically as regards pesticide pollution, as a fisheries research agency, our most pressing concern is that the levels of hard pesticides in the Great Lakes may already be at a point where they may affect reproduction in certain important species and ultimately negate the rehabilitation efforts undertaken to date. This environmental concern, however, should not be confused with the human health aspects of the pesticide problem. These aspects must be considered separately.

It is not possible for a regulatory agency such as the FDA to set some tolerance level which will automatically take care of both the environmental and the human health concerns. FDA must concern itself solely with the possible threat to human health, whereas fisheries scientists must concern themselves with the environmental aspects.

We have joined with the Michigan Department of Natural Resources in taking a firm stand against any further use of DDT and other hard pesticides. We have been monitoring pesticides in the Great Lakes for 5 years and have extensive data on the subject.

OYSTER INSTITUTE HONORS BUREAU OF COMMERCIAL FISHERIES

The Oyster Institute of North America (OINA) recently awarded identical plaques to the Bureau of Commercial Fisheries (BCF) and to the Bureau's Division of Statistics and Market News.

In a ceremony in Washington, D. C., Cranston Morgan, President of OINA, made the presentations, thanking BCF for its services to the Institute over the years.

Brief acceptance remarks were made by Charles H. Meacham, Commissioner for Fish and Wildlife; Philip M. Roedel, BCF Director; and Frank Riley, Acting Chief, Division of Statistics and Market News.

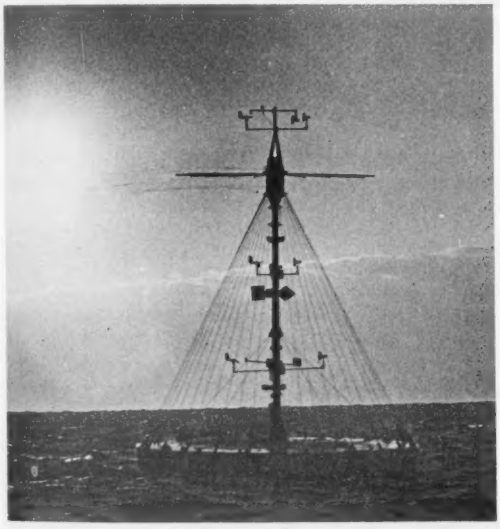
Left to Right: Cranston Morgan, President, OINA, Weems, Va.; William R. Woodfield (Former President), Galesville, Md.; Frank P. McGinnes, Vice President, OINA, Irvington, Va.; John L. Plock, Greenport, L. I., New York; Charles H. Meacham, Commissioner, Fish and Wildlife Service, U.S. Dept. of the Interior; Elizabeth M. Wallace (Mrs. David H. Wallace), Executive Director, OINA, Sayville, L. I., New York; Robert L. Doxsee, Point Lookout, L. I., N. Y.; Frank Riley, Bureau of Commercial Fisheries; Edward J. Gruble (Immediate Past President), Seattle, Wash.; Clifford V. Varin, West Sayville, L. I., N. Y.; Nelson Slager, Bay Shore, L. I., N. Y.; Richard H. Loring, Dennis, Mass.; Philip M. Roedel, Director, Bureau of Commercial Fisheries.
Joseph O. Saunders, Newport News, Va., Chairman of OINA's Education, Promotion, and Marketing Committee was not present when photograph was taken. (Photo: Bob Williams)

OCEANOGRAPHY

AUTOMATED WEATHER BUOY AT WORK OFF VIRGINIA

On Jan. 31, the U.S. Coast Guard anchored a 100-ton automated weather buoy approximately 125 miles east of Norfolk, Va. (latitude 36°30' N., longitude 73°30' W.) on northern edge of main Gulf Stream; later, 200 miles to northeast, the Coast Guard cutter 'Gresham' began to man Ocean Weather Station 'Hotel,' the second part of a floating weather station team. The buoy began flashing weather observations across the U.S. to a computer at the Scripps Institution of Oceanography in La Jolla, Calif.

The Coast Guard states that data gathered by these floating weather stations will be transmitted to the main U.S. weather teletype network for use in forecasting. ESSA's Weather Bureau has discovered that severe weather conditions formed in this area can migrate northward along the Atlantic Coast undetected by shore-based facilities.



Automated weather buoy off Virginia.
(Photo: R. E. Tilley, 5th Coast Guard Dist.)

It is hoped the weather buoy and the Gresham will help to improve Weather Bureau forecasting for the East Coast.

The Data Gathered

The 100-ton buoy is 40 feet in diameter and has a 45-foot mast. It gathers hourly data on "air and water temperatures, barometric pressure, winds, dew point, solar radiation, precipitation and surface water currents." The data are stored in a computer inside the buoy. Every 6 hours, the shore-based computer in California interrogates the computer and receives and interprets its radio transmission.

Weather Buoy

The buoy is held on station by a 3-inch plaited nylon line attached to a 3-ton anchor weighted by 18,000 pounds of chain. The 2-mile mooring line allows the buoy to swing in a circle about $1\frac{1}{2}$ miles in diameter. It warns off passing ships with a flashing xenon light, similar to the strobe unit of a flash camera.

National Project

The experimental buoy is part of the Coast Guard-managed National Data Buoy Development Project that began in late 1967. If the project continues to appear feasible, a network of similar buoys may some day be placed to provide oceanographic as well as meteorological data.

The weather buoy is scheduled to remain on station until July 1970, when it will be brought in for overhaul. It will be restationed in August for a year's service.

SEARCH BEGINS IN GULF FOR DANGERS TO SHIPPING

A wide search for dangerous obstructions to shipping in the Gulf of Mexico was launched February by the Coast and Geodetic Survey (CGS). It will be carried out primarily in fairways leading into ports in Texas, Louisiana, Mississippi, Alabama, and Florida.

The only wire drag vessels in the U.S., the 'Rude' and 'Heck', left Norfolk, Va., their home port, for Corpus Christi, Texas, their base this year.

First Charted in 1966

The fairways were first charted in 1966 to guide coastal and ocean-going vessels safely between the numerous oil well platforms rising above Gulf surface as far out as 60 miles. No drilling structures are allowed in the fairways.

The ships' mission will be to search the fairways for partially removed oil platforms, sunken vessels, or other submerged hazards to vessels.

Eastward From Texas

The ships begin off Texas and will work eastward towing a submerged wire between them as they sweep the assigned areas. Shipping will be advised immediately through "Notice to Mariners" of hazardous obstructions. CGS charts will be corrected. The wire, towed at various depths down to 60 feet, will be kept close to bottom in fairways and in shallow areas.

Search for Sunken Wrecks

The sunken wrecks to be searched for include commercial and pleasure ships now noted approximately on nautical charts.

FAST-RESPONSE OXYGEN SENSOR TESTED

A newly developed sensor designed to give accurate, on-the-spot measurements of the water's oxygen content may soon replace present methods of recording oxygen levels.

This is the prediction of Quick Carlson, a civilian oceanographer at the U.S. Naval Oceanographic Office (NOO).

Carlson and his scientific team tested the new sensor to depths of one mile at 23 different Pacific locations while their oceanographic research ship, the USNS 'Davis' steamed from Yokosuka, Japan, to San Francisco.

Oxygen measurements returned by the sensor verified the general oxygen structure of the Pacific Ocean along the ship's route--close to the 34-degree north latitude line. They also revealed details of oxygen layering (oxygen levels at different depths) that could not be captured by the Nansen bottle.

Nansen Bottle Method

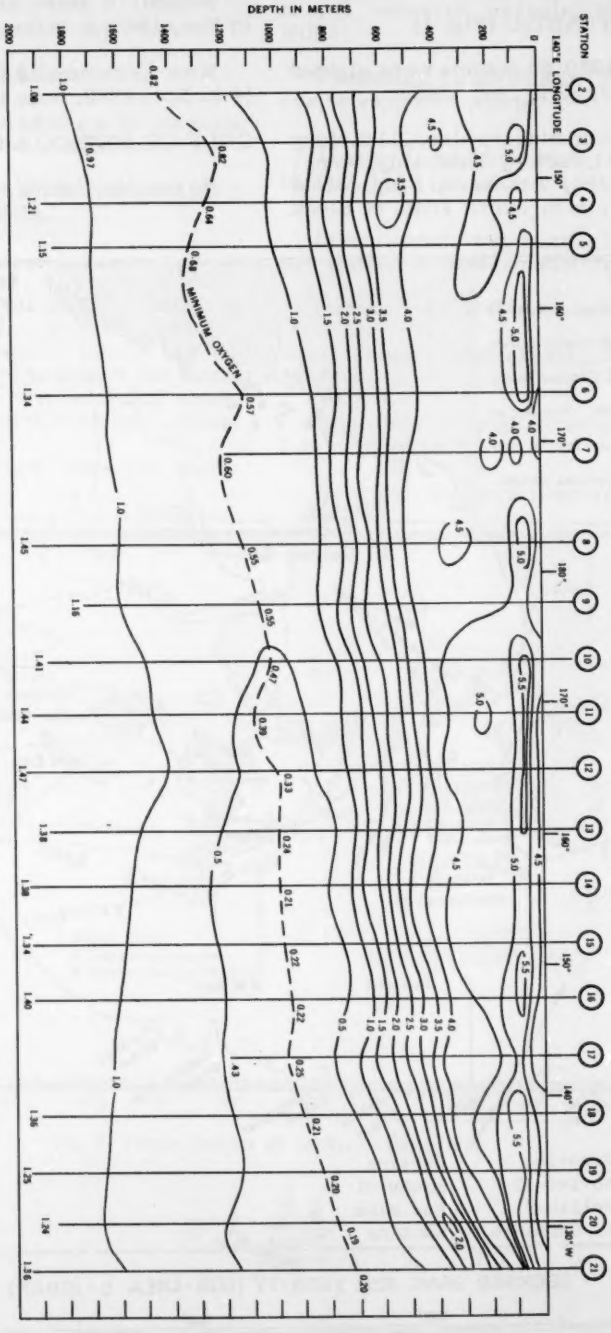
This older method is reliable but tedious. It includes several steps: placing numerous Nansen bottles (water samplers capable of capturing small amounts of water at predetermined depths) on an oceanographic cable, lowering and retrieving these bottles, and chemical analysis of the samples.

Sensor Is 1 Step

The sensor is a one-step method of collecting oxygen data. While it is being lowered through the ocean depths, it can provide continuous oxygen measurements in the form of electrical signals transmitted up a long oceanographic cable.

Carlson predicted: "As a result, the sensor should give us detailed, on-the-spot oxygen levels from all depths, in direct contrast to the spot-check readings we are now getting through the use of the Nansen and similar methods."

If further tests continue to support his view, Carlson predicted, the sensor will become an "easy-to-use, fast-response tool for oceanographers needing accurate oxygen measurements to determine the overall distribution of dissolved oxygen in all ocean waters, regardless of depth and area."



DISSOLVED OXYGEN — ml/LITER

FOREIGN FISHING OFF U.S., DECEMBER 1969

NORTHWEST ATLANTIC (Fig. 1)

In December 1969, 80 vessels were sighted (105 in Nov. 1969; 36 in Dec. 1968).

USSR: 36 medium side trawlers, 11 factory stern trawlers, 1 factory base ship, 4 refrigerated carriers, 2 tankers, 1 tug. Most were along 30-fathom curve south of Block Island and Nantucket, a few on Georges Bank. (50 in Nov. 1969; 29 in Dec. 1968).

Poland: 6 stern and 3 side trawlers (17 in Nov. 1969; 6 in Dec. 1968).

West Germany: 8 freezer stern trawlers (4 in Nov. 1969; none in Dec. 1968).

GULF OF MEXICO & SOUTH ATLANTIC

No foreign fishing vessels reported.

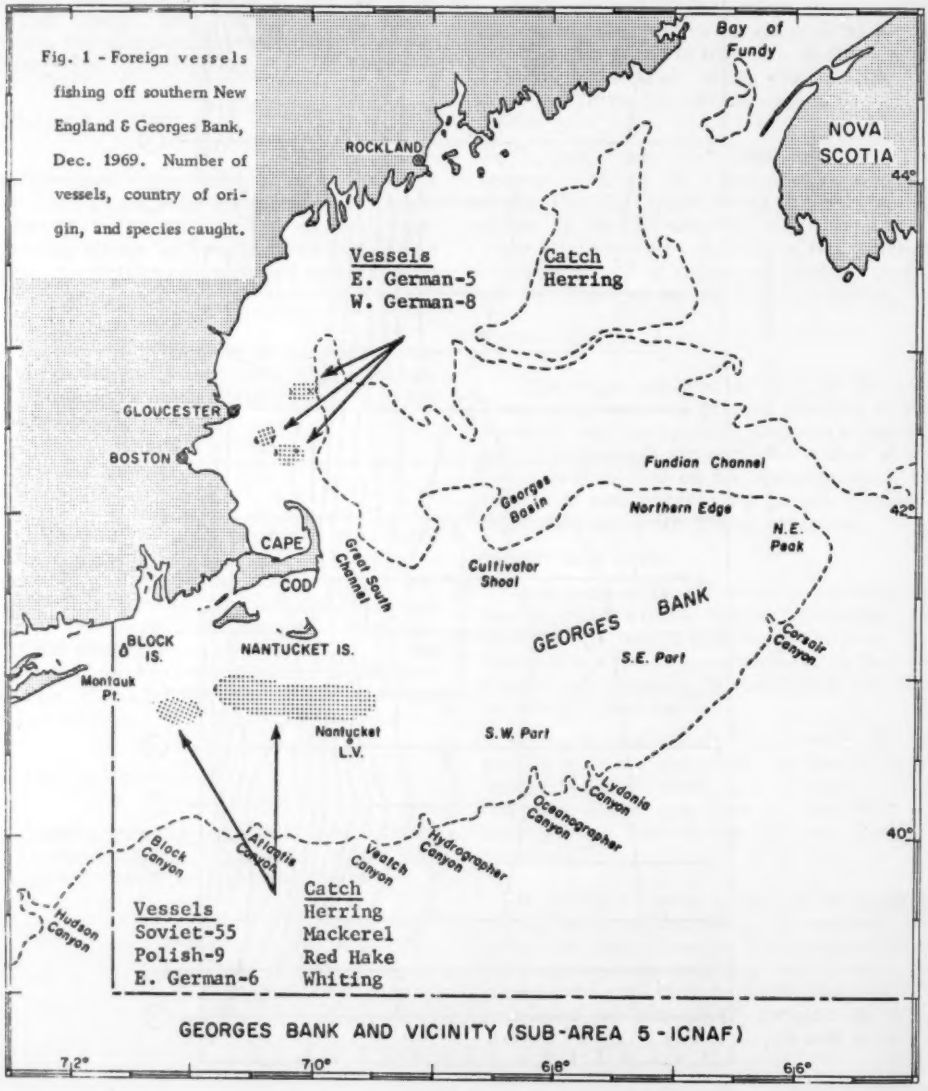


Fig. 1 - Foreign vessels fishing off southern New England & Georges Bank, Dec. 1969. Number of vessels, country of origin, and species caught.

GEORGES BANK AND VICINITY (SUB-AREA 5 - ICNAF)

OFF CALIFORNIA

No foreign fishing vessels reported.

OFF PACIFIC NORTHWEST

USSR: No vessels sighted (1 medium trawler off Oregon in Dec. 1968).

Japan: 6 longliners--3 off Washington, 3 off Oregon (1 in Dec. 1968).

OFF ALASKA (Fig. 2)

USSR: 125 vessels (31 in Nov. 1969; 110 in Dec. 1968).

Ocean Perch: 6 stern trawlers 1st week; 2 stern and 2 medium trawlers 2nd week. After mid-month all switched to Bering Sea.

Groundfish: 17 medium trawlers and 1 refrigerated transport.

Herring: 25 stern and 38 medium trawlers, 2 research vessels, over 15 support ships.

Flounder: 12 stern and 10 medium trawlers, 4 support vessels.

Japan: About 35 vessels, 5-10 fewer than in Nov. 1969 (40 in Dec. 1968).

Ocean perch: 4 stern trawlers--3 in eastern Gulf, 1 in eastern Aleutians.

Groundfish: 5-6 stern trawlers.

Flounder: 1 factoryship, 6 trawlers, 1 reefer.

Sablefish: 4 longliners--3 in eastern and 1 in central Gulf.

Herring: 10 stern trawlers, 2 reefers.

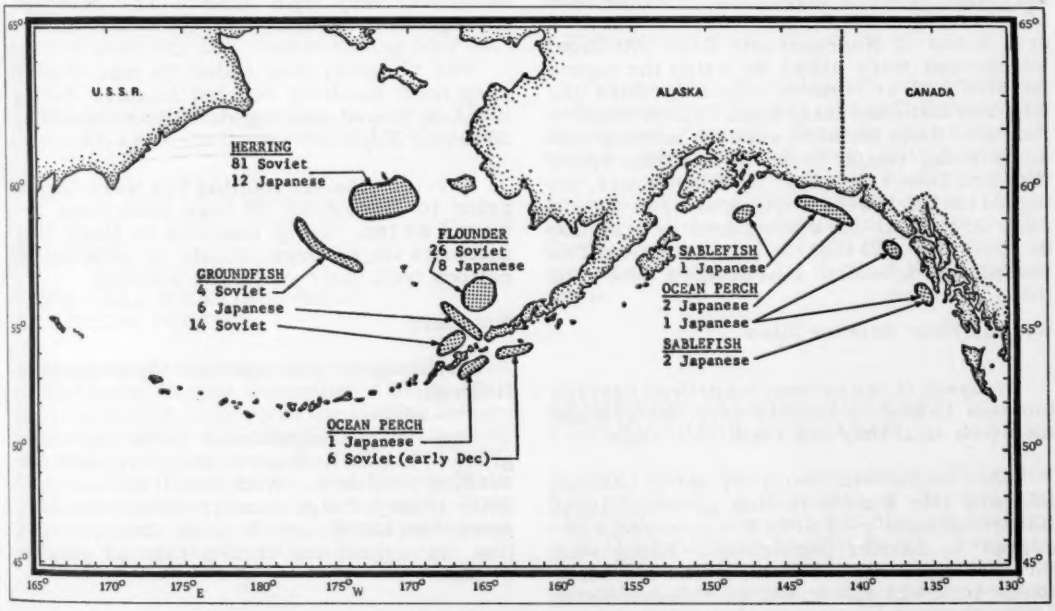


Fig. 2 - Foreign fisheries off Alaska, December 1969.

STATES

RHODE ISLAND

SEED-LOBSTER PROGRAM UNDERWAY

For more than a decade, with Rhode Island's approval, some local trawlers lobstering the offshore regions of the continental shelf have been bringing in egg-bearing female lobsters and releasing them in Rhode Island waters. For identification, the fishermen tie strands of nylon rope to the lobsters before releasing them. Local fishermen reported catching lobsters marked this way and finding the lobsters often had shed their eggs. This information has been collected by Stephen Fougere, Conservation Officer in Rhode Island's Department of Natural Resources.

Tag & Release Berried Females

During March-April 1965, with the cooperation of several off-shore trawlers, conservation officers tagged and released 1258 off-shore berried female lobsters into several areas of Narragansett Bay. All local lobstermen were asked to watch the tagged females and to remove tags only after the lobsters had shed their eggs. Early reports indicated these lobsters were not moving with many being caught in the same areas where they had been released. By midsummer, the tagged lobsters were being recovered without eggs throughout the state's lobster grounds; by April 1966, 495 tags had been returned. The recaptured lobsters represented 39.3% of those released.

Remain Near Release Sites

Analysis of tag recoveries proved berried females tended to remain near the release locations until they had shed their eggs.

Since the introduction of off-shore berried lobsters into state's fishing grounds, local fishermen have reported a noticeable increase in lobster populations. Along with this increase, heavy concentrations are being found in areas never before commercially productive.

Asked by local commercial lobstermen, the 1968 General Assembly appropriated $10,000 to finance transferral of berried female lobsters from off-shore banks into Rhode Island lobster grounds.

Program In 1969

In January 1969, all Rhode Island trawler captains in the off-shore lobster fishery were contacted about the program. Fourteen asked to participate and agreed to comply with rules on transporting berried lobsters.

The Department of Natural Resources agreed to pay fishermen one dollar for each lobster, regardless of size, provided it was fully berried and delivered in good, lively, condition.

From Jan.-May 15, 1969, 4071 female berried lobsters were delivered from the off-shore canyons and released by conservation officers throughout the state's lobster grounds. These lobsters varied from one pound up to 10 pounds. The overall average weight of the seed lobsters was about $2\frac{1}{2}$ pounds. Condition at time of release was excellent; very light mortality occurred throughout program.

The program was ended by mid-May to keep from handling berried females during hatching stages, which generally occur during June and July.

Berried lobsters totaling 714 were tagged prior to liberating; 89 tags have been returned so far. Early analysis of these tags indicates the seeders remain at release locations until their young are hatched.

Summary

Mr. Fougere summarizes the program's findings:

Egg lobster populations on the off-shore grounds at this time are readily available for seeding purposes. With relative ease and little money, large numbers of berried lobsters can be stocked in good, lively, condition throughout the state's inshore lobster grounds.

The displaced berried lobsters definitely remain near release locations until their young are liberated.

After releasing their young, favorable numbers of stocked lobsters are recovered and sold by commercial lobster fishermen.

This recovers a substantial part of the initial cost of moving the breeders inshore.

An annual program of purchasing and releasing 5,000 egg-bearing lobsters into the state's lobster grounds can be conducted without any major state expenditure.

Rhode Island plans to continue the program in 1970.

CALIFORNIA

ANCHOVY CATCH QUOTA RAISED

On Jan. 9, 1970, the California Fish and Game Commission approved a 65,000-ton increase in anchovy catch for use in producing fish meal and oil--32,500 each in inshore and offshore zones of Southern Permit area.

This increases total quota for reduction to 140,000 tons for the season ending May 15, 1970.

From the season's opening in August 1969 to Dec. 28, 1969, landings totaled 48,600 tons.

OREGON

TOWN HALL MEETINGS HELD AT FISHING PORTS

Town Hall meetings were held at Oregon fishing ports during December 1969 to discuss matters of concern to the fishing industry, reports BCF's Pacific Northwest Region. The meetings, sponsored jointly by BCF, Oregon Fish Commission, and Oregon State University, took place at Brookings, Coos Bay, Newport, and Astoria. Representatives of these agencies participated.

ALASKA

NO CLOSED SEASON FOR SCALLOP

Starting Jan. 1, 1970, there would be no closed season on scallops, the Alaska Department of Fish and Game stated Dec. 12, 1969. This action was justified because biologists, monitoring commercial scallop fishing in the Kodiak management area, found a very low incidental catch of king and tanner crabs.

Scallop landings in Kodiak area reached a record 927,000 pounds during January through November 1969; this compared with 607,000 pounds for all of 1968.

* * *

NEW HERRING RESEARCH PROGRAM IN SOUTHEASTERN ALASKA

A new herring research program in Southeastern Alaska has been designed to answer basic management needs concerned with herring abundance. The program's long-range goals are to: 1) determine separate stocks and their boundaries; 2) enumerate, or index yearly, fluctuations of the stocks; 3) determine causes for yearly fluctuations in abundance; and 4) estimate optimum harvest of these stocks.

2 Fisheries

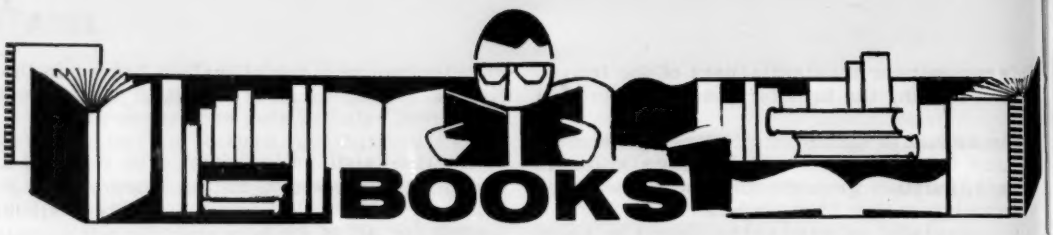
Two herring fisheries are now operating in Southeastern Alaska: the bait fishery and the spawn fishery. Because Ketchikan is close to the greatest fishing activity, studies will be conducted from there. It offers ready access to fishing and spawning areas. Most studies will be conducted in Ketchikan and Craig areas. But there will be some work on abundance and spawning in other Southeastern areas.

* * *

STATEWIDE SALMON-FORECAST PUBLICATION IS AVAILABLE

The Division of Commercial Fisheries has prepared "A Summary of Preliminary 1970 Salmon Forecasts for Alaskan Fisheries" (Informational Leaflet #136). "Preliminary salmon forecasts are presented for specific fisheries and are also combined to provide projected commercial harvest levels for 1970 for the entire state."

Write for copy to: Mrs. June Grant, Alaska Department of Fish and Game, Subport Bldg., Juneau, Alaska 99801.



ATLANTIC COASTAL ZONE

"The Wildlife Wetlands and Shellfish Areas of the Atlantic Coastal Zone," by George P. Spinner, Folio 18, Serial Atlas of the Marine Environment, 4 pages of text and 12 color plates, $12. "A Plan for the Marine Resources of the Atlantic Coastal Zone," $4. Order from the American Geographical Society, Broadway at 156th Street, New York, N. Y. 10032.

The folio summarizes a 3-year study of the marine resources of the Atlantic coast. Data on finfish, shellfish, and wildlife were collected from all available sources. All land-use planning reports and recreation and water-resource development plans on all levels of government were examined to ascertain their probable effects on marine resources.

The 12 maps show the two most reliable indicators of value uncovered: the ownership, or proposed acquisition, of coastal salt marshes by government conservation agencies, and the location of important shellfish beds. Salt marshes believed to be of value for fish and wildlife conservation purposes, but still vulnerable to destruction, also are shown. The maps depict a proposed zoning of the coastal zone from the standpoint of conservation of marine resources.

The book, in conjunction with the folio, gives the opinions of Mr. Spinner and members of his marine resources committee on preserving the remaining wetlands of the Atlantic coastal zone. It includes descriptions of present and proposed preservation programs, examines the economic value, legal aspects, and competing uses of the coastal area, and outlines program goals. It is a plea both for prompt action and for meaningful and effective cooperation by all who share responsibility for the wetlands. This book should generate much discussion, a major purpose of its publication.

BIOLOGY

"Development of Fishes of the Chesapeake Bay Region: An Atlas of Egg, Larval, and Juvenile States: Part I," by Alice J. Mansueti and Jerry D. Hardy Jr., edited by Earl E. Deubler Jr., University of Maryland, Natural Resources Institute, 1967, 202 pp., illus.

Knowledge of early developmental stages of fishes is fundamental to proper understanding of many aspects of fishery biology and ichthyology. However, the eggs, larvae, and juveniles of many species are unknown and undescribed. This book is intended to be an illustrated work manual for biologists in identifying early developmental stages.

It summarizes information on early stages of 45 species from 14 families--sturgeon, gar, bowfin, tarpon, bonefish, herrings, anchovies, mud-minnow, pikes, lizardfishes, minnows, suckers, sea catfishes and catfishes. Although morphological descriptions of early developmental stages are emphasized, descriptions of adults and comments on distribution, ecology and spawning have been included.

EELS

"The Eel Fisheries of Eastern Canada," by J. G. Eales, Bulletin No. 166, Fisheries Research Board of Canada, 1969, 79 pp., illus., $1.75. Order from Queen's Printer, Ottawa, Canada, Cat. No. Fs 94-166.

This bulletin gives the results of a survey of eel fishing in Canada made in summers of 1965 and 1966. The survey was made to describe various methods of capture and to assess the exploitation of eels. Mr. Eales includes a general description of the biology, distribution, and life history of the American eel, Anguilla restrata, fishing techniques, optimum times of fishing, and methods for holding, transporting, and processing.

COMMERCIAL SHRIMP FISHING

"Opportunities in the Shrimp Fishing Industry in the Southeastern United States," Sea Grant Information Bulletin No. 3, University of Miami, 1970, 28 pp. Available from Sea Grant Advisory Services, Rosenstiel School of Marine and Atmospheric Sciences, 10 Rickenbacker Causeway, Miami, Florida 33149.

This publication answers the principal questions asked by those interested in participating in the shrimp industry--the amount of initial investment required, the economic return that can be expected, the reasons for fishing regulations, and the location and availability of shrimp at various fishing grounds. Sections on innovations in gear and boat construction, and the list of sources for financing the purchase, reconstruction or reconditioning of a shrimp trawler will be of interest to present shrimp fishermen.

The Sea Grant Bulletins are a new series aimed at transmitting information from the scientific community to the public. Future bulletins will discuss the role of marshes in commercial and sport fish production; lobster and shrimp culture; sanitary problems and standards on fishing vessels; various aspects of ocean law; Sea Grant and the community; and other subjects dealing with the practical problems involved in the development of the oceans. The University would welcome suggestions for other types of information that the public would like to receive under this program.

FISH BEHAVIOR

"The Central Nervous System and Fish Behavior," edited by David Ingle, University of Chicago Press, 1968, 272 pp., illus.

This book is made up of 20 papers presented at a meeting intended to promote an interdisciplinary attack on brain function, and to give impetus to the study of teleost fishes. The 4 major sections are: Anatomy and Function of the Fish Visual System; Anatomy and Function of Fish Forebrain; Physiological Aspects of Fish Behavior; and Behavioral Processes in Fish.

MICROBIOLOGY

"Microbiology of Oceans and Estuaries," by E. J. Ferguson Wood, Elsevier Publishing Co., New York, 1967, 319 pp., illus. Excluding the seaweeds around the coasts, the major part of plant life in the water is microbial. Even in sea-grass beds, the microbial epiphytes represent a biomass of the same order as the accompanying sea-grasses and larger seaweeds. Interest in marine microbiology has grown so great in recent years that all other branches of oceanography and marine biology look increasingly to the microbiologist for help and information.

This book is intended primarily to introduce students to the discipline of the microbiology of oceans and estuaries. It also will aid the researcher desiring a resumé of this microbial world, and brief him in the modern trends of thought about the activities of microorganisms in physical and chemical phenomena in the seas.

PLANKTON

"Marine Plankton: A Practical Guide," by G. E. and R. C. Newell, Hutchinson Educational Ltd., Great Portland St., London, W1, England, revised 1967, 221 pp., illus.

This manual attempts to give zoology students a concise account of the kind of practical study of plankton they might make at sea, or in the lab. Although mainly concerned with species found around the British Isles and adjacent seas, it should be valuable to students everywhere for its examination of methods of plankton collection, sorting, and quantitative estimation.

POND FISH CULTURE

"Proceedings of the World Symposium on Warm-Water Pond Fish Culture," FAO Fisheries Report No. 44, Vol. 4, edited by T.V.R. Pillay, Rome, January 1968, 492 pp.

This is the fourth volume of the symposium proceedings. It contains review, experience, and working papers dealing with breeding and selection, biological and other methods of increasing production, and standardization of research techniques.

PROCESSING

"Use of Sodium Nitrite in Smoked Great Lakes Chub," by K. G. Weckel and Susan Chien. Research Report No. 51, 4 pp., Sept. 1969, University of Wisconsin.

In the past few years, several outbreaks of botulism have resulted from consumption of improperly handled or processed smoked Great Lakes chub. Since sodium nitrite ($NaNO_2$) can inhibit the growth of microorganisms, the use of 100 to 200 p.p.m. in smoked chub has been proposed. This report describes the procedures and results of studies made to determine the rates of uptake and retention of $NaNO_2$ in smoked chub.

RED SALMON

"Further Studies of Alaska Sockeye Salmon," edited by Robert L. Burgner, Publications in Fisheries, New Series, Vol. III, University of Washington, Seattle, 1968, 267 pp., illus., $3.60.

The lake systems of southwestern Alaska produce nearly half the North American pack of sockeye, or red, salmon (Oncorhynchus nerka). Studies of this valuable resource by the University of Washington were initiated in 1946 at the request of the Bristol Bay salmon packers.

The first volume of the series, "Studies of Alaska Red Salmon," reported on research conducted on sockeye runs of Bristol Bay and Kodiak Island. Volume II dealt with salmon gear limitation in northern Washington waters and management of the high-seas fisheries of the northeastern Pacific. This volume, the third, contains 6 articles on sockeye salmon research--5 on Bristol Bay and one on the Chignik lake system. They include a comparison of salmon fry food, distribution and growth of sockeye fry, identification of adult sockeye groups, age determination by otolith, egg development, and surveys of spawning populations. All contribute toward an understanding of the complex factors controlling sockeye population levels in the lake systems, and of the number of spawning salmon needed to produce the highest sustained yield.

WATER POLLUTION

"Trace Metals in Waters of the United States: A Five Year Summary of Trace Metals in Rivers and Lakes of the United States (Oct. 1, 1962-Sept. 30, 1967)," by John F. Kopp and Robert C. Kroner, Department of the Interior, Federal Water Pollution Control Administration, 1969. Copies available from Analytical Quality Control Laboratory, Division of Water Quality Research, 1014 Broadway, Cincinnati, Ohio 45202.

Water for fish propagation must be substantially free from domestic and industrial pollution, and must be able to sustain the flora on which fish feed.

In determining water-quality requirements for aquatic life, it is essential to recognize that there are not only acute and chronic toxic levels, but also tolerable, favorable, and essential levels of dissolved materials. Different species, and different developmental stages of the same or different species, may differ widely in their sensitivity or tolerance to different materials. Also, substances in suspension, as well as in solution, affect aquatic organisms both directly and indirectly.

Adequate water-quality surveillance is essential to identify compliance with water-quality standards--in order to document violations for corrective actions, and to identify new pollution trends, sources, and types before problems develop.

This report provides detailed summaries of data on 19 trace metals detected at over 100 water-quality surveillance stations in the 16 major river basins of the U.S. Numerous tables include percent frequency of detection, observed mean values, highest recorded concentrations, number of violations of quality criteria, and comparisons of suspended and dissolved trace metals in surface water.

--Barbara Lundy

INTERNATIONAL

FAO FISHERY AID TOPS $120 MILLION

During the 1960s, FAO fishery aid to developing countries under the United Nations Development Programme (Special Fund) grew steadily--from 3 projects in 1960, the first year, to 48 in 1969. This was reported by FAO Jan. 15, 1970.

The 48 projects involved 37 countries in 5 continents and almost $120,000,000 in UNDP and government counterpart funds. The first year's projects totaled $6,400,000.

The 48 Projects

The 48 projects, most still operational, range from fishery resources surveys, conducted aboard modern, FAO-designed research vessels, to training personnel and studying marketing and distribution problems. Most projects are fashioned to the needs of nations and are scheduled to run 4-5 years. Also, FAO's Department of Fisheries is studying 21 new projects and is participating in 14 others involving other departments.

Largest project financially is the $13,400,000 High Seas Fishery Research project in Poland; the latter has contributed $12,200,000 to build a modern, computerized fishery research vessel. The 4 year project, launched in 1968, involves training and educating fishery personnel from developing countries.

Central America

Another major project is the 6-year, $5 million Central American Fishery Development program for Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. Begun in 1966, it aims to increase production and consumption of fish and fish products in a region where fish eating and nutritional standards are low.

S. Korean Training Center

A Deep Sea Fishing Training Centre was established in Pusan, Republic of Korea, under a $2,850,000 project that ended in late 1969. FAO continues to assist through other arrangements. The Centre turns out 150 qualified skippers and engineers a year.

FAO also established a Coastal Fishing Training Centre in Pusan in 1968, under a $2,500,000, five-year project.

In South Vietnam, FAO assists an Off-Shore Fishery Development program in which the Freedom From Hunger Campaign participates with a $2,250,000 contribution. The total UNDP-Government contribution to the 4-year project that started in 1968 is $2,000,000.

Africa & S. America

Lake Victoria in Africa was the site of another FAO fishery survey and development project. A specially built, 56-foot research and exploratory fishing vessel was transported by sea and land from the United Kingdom. Africa's great manmade lakes--Kariba, Volta, Kainji, and Nasser--and its eastern and western coastal waters also are being studied by FAO/UNDP.

In Argentina, noted for its beef, efforts are underway to increase fishery production and consumption.

A study has begun of ways to tap the little-used resources of the Indian Ocean.

50 Smaller Projects

As of December 1969, FAO also was conducting about 50 smaller projects under UNDP Technical Assistance Programme.

FAO Aid Has Changed

The trend towards more and bigger fishery development projects was emphasized by Harry C. Winsor, Director for Operations in FAO's Department of Fisheries and former head of the 16-nation Caribbean Fishery Development project. He said this reflected FAO's evolvement from a fact-gathering organization into a development agency with international financing to provide technical services in all disciplines of food and agriculture.

Mr. Winsor added: "We have come a long way from 1960 when we had two fishery projects going, in Ecuador and Peru, and a third project starting in India. By 1965 we were involved in 17 projects and by the following year with ten more. And this is just in the UNDP Special Fund sector.

He predicted future projects will continue to cover many fields. The projects preferred will be those that benefit nations quickly through orderly expansion of the fishing industry--and make fish available to more consumers everywhere.

FAO BODY GATHERS FACTS ON MEDITERRANEAN POLLUTION

The General Fisheries Council for the Mediterranean, an FAO body, will gather information on pollution of the Mediterranean Sea by sending questionnaires to many scientists, experts, and other interested groups throughout the Mediterranean.

The Council hopes that results of the questionnaire may help the FAO conference on marine pollution, and its effects on living resources and fishing, slated for Rome, Dec. 9-18, 1970.

The Council held its 10th biennial session in Rome in December 1969. It noted an urgent need for Mediterranean countries to obtain the best information on the status and trends of pollution.

Member countries will be asked to nominate pollution experts to be liaison with the Council; nonmember nations bordering the Mediterranean also will be asked to nominate experts.

Rome Meeting

At Rome, the Council noted that pollution of the Mediterranean was a fast-growing problem. It was aggravated by the sea's enclosed nature: "waste may not be rapidly diluted and dispersed by natural processes."

Coastal areas and high seas are contaminated by domestic and industrial waste brought into the sea by rivers, coastal outlets, pipelines, and dumping by vessels.

Overfishing

The Council noted "definite signs of overfishing in the case of some species. This alarming situation has already led several Mediterranean countries to promote measures to reduce fishing effort." It recommended "rational measures" to protect and renew threatened stocks. Stocks could be protected by limiting fishing effort and by using more selective types of gear.

Norway lobster was among species whose size had declined appreciably in the last 20 years. Deep-water fishing was having a "negative effect" on species.

COMMON MARKET'S FISHERIES POLICY DELAYED AGAIN

The effective date of the European Communities (EC) Common Fisheries Policy has been moved to May 1, 1970. The Jan. 1, 1970, deadline could not be met. The new date was announced following the mid-December 1969 meeting of EC Council of Ministers.

NEAFC BEGINS JOINT ENFORCEMENT PROGRAM

The Northeast Atlantic Fisheries Commission's (NEAFC) joint enforcement program began Jan. 1, 1970. Under this plan, both nets and catch of fishing vessels of member countries may be inspected on the high seas, within the NEAFC area, by recognized inspectors from a member country to see if Commission rules are being followed.

Area

The NEAFC area lies east and north of lines drawn south from Greenland and west from southern tip of Spain.

Regulations

NEAFC rules regulate mesh size, use of topside chafers, and minimum sizes for certain species.

Countries Affected

The plan affects: Belgium, Denmark, France, Iceland, Norway, Poland, Portugal, Spain, Sweden, U.K., and the USSR. In the case of the USSR, Poland, and Sweden, there will be no inspection of catch or gear below decks, and no inspection of the catch anywhere on board Soviet vessels. ('Fishing News,' Jan. 9, 1970.)

□□□□□□□□

NETHERLANDS TO WITHDRAW FROM INTERNATIONAL WHALING COMM.

The Netherlands has announced that it will withdraw from the International Whaling Commission effective June 30, 1970. (U.S. Dept. of State, Dec. 31, 1969.)

FISH CAGED TO CONTROL BIRTH

Fishery scientists have found a birth-control method for Tilapia aurea, a species that tends to overpopulate in fish ponds, reports FAO. By enclosing these fish in cages suspended in ponds, scientists find they discourage spawning; also, any eggs produced by the females, who hatch them in their mouths, fall through bottom of cages and are lost.

Tilapia are edible fish found mainly in fresh water. They resemble the freshwater sunfish. Tilapia reproduce so prolifically in normal pond conditions that a stock of 7,000 to 15,000 in a hectare of water can explode to 350,000.

The cage-suspension method was devised by biologists at the agricultural station of Auburn University, Auburn, Alabama, U.S., after two years of experiments.

Other Projects

This and other developments are reported in latest issue of FAO Fish Culture Bulletin (Vol. 2, No. 1, Oct. 1969), a quarterly review of world fish-culture research and development.

In Czechoslovakia, warm water effluents from power plants were used to heat carp ponds at Brno. Breeding was speeded one month.

Grass carp were used to control weeds in rearing ponds at the National Fish Hatchery in Marion, Alabama, of the U.S. Bureau of Sport Fisheries and Wildlife. Extensive floating mats were eliminated in 30 days after ponds were stocked with grass carp fingerlings.

In Poland, production of young carp was doubled in fingerling ponds by using nitrogen-phosphorous fertilizers. A 4-fold increase was registered in ponds fertilized with ammonium sulphate and superphosphate in which fish received supplementary feeding. The 4-year study took place in Zabieniec.

Taiwan reports successful spawning of black carp accidentally introduced with grass carp imported from Hong Kong several years ago. Spawning was induced artificially through injections of pituitary extract, which stimulate reproduction.

NORDIC NATIONS SET MINIMUM PRICES FOR FROZEN FILLET EXPORTS

The Nordic countries have agreed on a minimum price system for frozen fish fillet exports to the United Kingdom and Sweden. In Oct. 1969, the U.K., Denmark, Iceland, Norway, and Sweden tentatively had agreed on a minimum price system in the U.K. Sweden had indicated a desire for a similar system in her domestic market. She feared it would become a dumping ground for excess production not sold in U.K.

U.K. Agreement

The EFTA Council approved the U.K. market arrangement on Dec. 15, 1969. It was to take effect Jan. 1, 1970. Minimum price system is supposed to achieve price stability at a level satisfactory to both parties. Minimum prices are enforced by suppliers--Denmark, Finland, Norway, Sweden, and Iceland (after she attains EFTA membership).

Swedish Agreement

A similar agreement for the Swedish market has not yet been signed. However, this agreement has no direct connection with U.K. minimum price system and will not change frozen fish fillets' duty-free status in Sweden. (U.S. Embassy, Copenhagen, Dec. 5, 1969; Jan. 5, 1970.)

A list of affected products and their U.K. market prices is available from BCF, Office of Foreign Fisheries, Wash., D. C. 20240.

SOVIETS EXPLORE INDIAN OCEAN FISH STOCKS

The Azov-Black Sea Fisheries Research Institute (AZCHERNIRO) conducted a survey of one of the least known areas of the Indian Ocean from December 1966 to April 1967. Cruising on the shelf between 25° and 7° N. latitude, the R/V 'Lesnoi' explored Wadge Bank off Cape Comorin.

Prevailing Species

The waters were rich in ichthyofauna; demersal species prevailed. Large concentrations of Cubiceps natalensis and Polinurichthus, and Chorophthalmus agassizi were found at 250-400 meters. Chorophthalmus made up 47.5% of the catches. It is a commercially valuable food fish, 15-21 centimeters long, weighing 35-75 grams. Cubiceps and Polinurichthus are among the Indian Ocean's most valuable food fishes. They are 14-15.8 centimeters long; average weight is 76 grams. Sizeable concentrations of hairtail (Trichiurus savala) also were discovered; average length 24.5 centimeters; average weight 98 grams.

AZCHERNIRO scientists believe Wadge Bank is potentially good commercial fishery during winter months. ('Rybnoe Khoziaistvo,' Nov. 1969.)

DIRECTOR OF NEW FAO FISHERY DIVISION NAMED

Herman Watzinger, internationally known engineer, expert in fishery development, and member of the Kon-Tiki expedition in 1947 under Thor Heyerdal, has been named director of FAO's new Fisheries Industries Division.

The division has 3 branches: fishing vessels and engineering, fishing gear and methods, and fishery products and marketing.

New Director

Mr. Watzinger took up his duties in Rome on Feb. 1. He had been managing a Fishery Research and Development project (FAO/UNDP) in Peru. He is a former managing director of Compania Pesquera La Gaviota S.A., a major Peruvian fish meal firm. He also has been associated with one of the main fish-processing enterprises in the U.S.; he has served with British, Danish, Swedish, and Norwegian firms specializing in refrigeration and fish-preservation equipment.

Engineer

Mr. Watzinger is a graduate mechanical engineer, Norwegian Technical College, Trondheim. He has conducted research and written about freezing fish fillets and preserving other foods. He belongs to the American Society of Refrigerating Engineers and the Norwegian Society of Engineers.

He joins two other division directors in Fisheries Department: Dr. Mario Ruivo, Fishery Resources Division, and Dr. James A. Storer, Fishery Economics and Institutions Division.

SOVIET VESSELS FIRE ON DANISH FISHING CUTTERS

On Dec. 8, 1969, Soviet naval vessels fired on 10 Danish cutters fishing in the Baltic Sea in international waters 60 miles off Klajpeda, Lithuania. There were no casualties; sails on one Danish cutter were damaged. The Danes fled, abandoning their fishing gear.

The cutters were fishing salmon on Hoburg Banks, a traditional Danish fishing area. The Soviet vessels were conducting naval exercises.

Danes Return

Two days later, when Soviet exercises ended, the Danes returned, recovered their gear and resumed fishing. The Soviets took 400 hooks belonging to one cutter, but returned them later. ('Berlingske Tidende,' 'Børsen,' Dec. 12, 1969; 'Fishing News,' Dec. 19-26, 1969.)

CANADA

LANDINGS IN MARITIME PROVINCES TOP BILLION POUNDS

On November 20, 1969, Canada's Department of Fisheries & Forestry announced that cumulative landings in the Maritime Provinces for the first 10 months 1969 were 1,102 million pounds worth $62.6 million. Landing in same period 1968 were 1,181 million pounds ($63.4 million) and, in 1967, 944 million pounds ($53.3 million).

* * *

EAST COAST SHRIMP FISHERY DEVELOPS

In 1965, exploratory fishing for pink shrimp (Pandalus borealis) was sponsored jointly by the Canadian Department of Fisheries and Forestry and the governments of New Brunswick and Nova Scotia. It was carried out to a limited extent off the Maritime Provinces. The results, plus 1966-67 explorations, led to the belief that it would be possible to take shrimp in commercial quantities in Chaleur Bay-Gulf of St. Lawrence and Passamaguoddy Bay-Bay of Fundy areas.

A few vessels were fitted out for shrimp fishing in the Gulf of St. Lawrence. These succeeded in landing fair quantities of shrimp in summer and autumn months. Winter ice curtailed their operations.

Fundy Fleet Grows

In Bay of Fundy area, 6 boats were fitted out for shrimp fishing in 1967. Results were so satisfactory that fleet increased rapidly to 30 boats. In 1968, it landed about 1.2 million pounds. The fleet has increased until it numbers over 40 boats landing about 2 million pounds a year.

Much of the catch is air-freighted to Scandinavia, where there is great demand for fresh, salt-cooked pink shrimp.

Some See 40 Million Lbs.

Some enterprising fishermen believe this fishery could yield up to 40 million pounds year. They are having shrimp trawlers specially designed and built for it. The fishery may soon rank among the world's important shrimp fisheries.

* * *

FISHING VESSEL INSURANCE PLAN IS RECAST

Low-cost insurance for most Canadian fishing vessels will begin in April 1970. Larger vessels--up to 100 feet registered length--will be covered for first time. New rate schedules will make the insurance plan financially self-supporting. Revenues should be sufficient to cover both insurance claims and administrative costs.

New Rates

The new rates are:

1% of appraised value of vessels appraised at C$5,000 or less; 2% if appraised value is $5,000 to $25,000; and 4% if appraised value is over $25,000.

Coverage

In the event of total loss: owners of vessels valued at $5,000 or less will receive 60% (70% in B.C.) indemnity of insured value; owners of vessels appraised from $5,000 to $35,000 can insure at 2% for a 60% (70% in B.C.) recovery of insured value, or they can insure for 95% recovery at the 4% rate; owners of vessels appraised at more than $25,000 (paying 4% premium) will receive 95% of insured value. There will be a 5% deductible for partial loss of vessels valued at more than $25,000. Boats valued at less than $25,000 will have a partial loss deductible of 15%.

The minimum insurable length of a vessel now is 18 feet. This limit will be removed and replaced by a minimum appraised value of $500.

7,500 Vessels Covered

Currently some 7,500 fishing vessels with an appraised value of $40 million are covered under the insurance plan. All are owned by individual fishermen and private companies. Public corporations operating large trawler fleets are not covered. ('Fisheries News,' Dec. 15, 1969.)

* * *

CANADA (Contd.):

SALT-COD DEFICIENCY PAYMENTS ANNOUNCED

On Nov. 10, 1969, Canada's Department of Fisheries and Forestry announced the amounts of 1969 deficiency payments to Atlantic coast salt-cod fishermen.

The payments are $4 a quintal on large and medium Madeira and $3.25 on Thirds (about 80% of the light salted cure). The payment on large and medium salt bulk is $2.50 a quintal, or $5 a draught. Payments will total about $2 million.

How Payments Calculated

The level of payments was calculated from prices received by fishermen for the year's production. Payments amount to half the difference between average price fishermen actually received and the government's target prices announced in spring 1969.

* * *

SALTFISH CORPORATION RECOMMENDED

A bill to establish a Saltfish Corporation that would stabilize and improve earnings of Atlantic Provinces fishermen producing cured fish (mostly cod) was introduced in Canada's House of Commons on Dec. 16, 1969. The Department of Fisheries and Forestry explained on Dec. 19 that such an organization would maximize returns from exports--and minimize assembling, processing, and marketing costs. It also could put traditional cured fish production in reasonable order and, if justified by demand, replace old and inefficient methods with modern processes.

To Be Sole Buyer

The Corporation would become the sole buyer of cured fish and of fish for curing, controlling the movement of cured fish in both interprovincial and export trade. It would establish a buying price for salt fish before the fishing season and distribute any surplus earned by the close of the production year to the fishermen.

Other Operations

Its operations would include buying, assembling, grading, processing, packaging, storing, selling and market promotion of fish and cured fish products. Services of private individuals and firms would be used if they could contribute to greater efficiency in these operations. For certain services, such as purchasing, private traders might be appointed as Corporation agents, on a commission basis.

* * *

FISHERIES RESEARCH BOARD USES SUB AS LAB

Fisheries Research Board scientists first established the feasibility of using a submersible for underwater research in 1968. Now they are going to use a new submarine, the 'Shelf Diver', to study herring, scallops, and crab in the Bay of Fundy and Gulf of St. Lawrence.

Shelf Diver

The Shelf Diver is 23 feet long and can accommodate 3 observers or divers. Operating down to 800 feet, it has a built-in decompression chamber allowing divers to emerge at those depths.

Bay of Fundy Herring & Scallops

A decline in herring stocks in Maritime fishery has caused considerable concern in Canada. Unlike West Coast herring, eastern stocks spawn at 40 to 60 feet. Shore spawning is the rule on the Pacific coast. Thus, it is relatively easy to check the spawn and make reasonably accurate predictions of future harvests. In the Bay of Fundy, scientists must go beneath surface to make accurate surveys.

Studies on queen crab populations in the Gulf of St. Lawrence, begun in 1969, will continue with special emphasis on trapping gear. Divers from the submarine will watch the effectiveness of various baits at 600 feet.

The submarine also will help in studies of scallop stocks and their placement on the ocean floor in the Bay of Fundy.

THE YUGOSLAV FISHERY IN THE ADRIATIC SEA

Richard L. Major

Yugoslavia maintains a small commercial fishery of approximately 25,000-30,000 metric tons a year in the eastern Adriatic Sea (fig. 1). In 1966-1968, her marine fisheries become more important because of decreases in freshwater catch (see Table). However, their contribution to total catch is only slightly higher than in 1948 (64.6% in 1948; 66.6% in 1968). It is estimated that an additional 2,000-3,000 metric tons are taken by inhabitants of the coast for food and by sport fishermen.

This report examines the small but interesting fishery: the fishing methods and catch; utilization of catch and the social and economic factors that influence it; and the fishery's prospects. It is based on four articles (Basioli, 1968; Grubelić, 1963; Grubešić, 1968; Morović, 1968) and on information gathered firsthand in Yugoslavia from February to August 1969.

FISHING METHODS AND CATCH IN ADRIATIC

The Adriatic Sea is not a uniform fishing area in terms of the type of fishery conducted. Different types of gear are used in four areas--the area embracing the shoreline and offshore banks (various dragnets, set-nets, traps, etc.), the trawling area, the open-water area (seines), and the deep-water area (long-lines). Each area is considered separately later.

Yugoslavia's Fisheries Catch for Selected Years 1948-1968

Fishery	YEAR						
	1968	1967	1966	1965	1960	1955	1948
	(In 1,000 Metric Tons)						
Marine	29.9	30.0	27.3	26.0	20.9	13.6	13.7
Freshwater	15.0	17.9	18.2	15.9	10.0	9.0	7.5
Total	44.9	47.9	45.5	41.9	30.9	22.6	21.2
Marine as % of Total . . .	66.6	62.6	60.0	62.1	67.6	60.2	64.6

Source: FAO Yearbook of Fishery Statistics.

Fig. 1 - Eastern shore of the Adriatic Sea showing locations important to this review. Inset shows the location of the Adriatic relative to the familiar land masses of Italy.

In 1968, 8,246 people were engaged in the fishing industry: 2,412 full-time fishermen, 5,456 part time, and 378 shore workers. Fishermen shared 25 to 40 percent of the net income. The fishery involved 6,349 boats, including 4,265 with motor and 2,084 without. Of the motorized craft, only 193 exceeded 10 gross registered tons. The 43,290 nets used included 40,264 set nets, 1,507 drag seines, 460 trawls of various types, 426 purse seines, and 633 nets of other types. Also used were 16,083 basket-traps and over 1.3 million long-line hooks.

Fish make up about 96 percent of the catch; the rest are crustaceans (crabs and lobsters) and molluscs (oysters, mussels, octopus, and squid). The so-called blue or pelagic fish

Mr. Major is a Fishery Biologist with BCF Biological Laboratory, 2725 Montlake Boulevard E., Seattle, Wash. From February through August 1969, he was in Yugoslavia on a scientific exchange visit sponsored by Academies of Science of the U.S. and Yugoslavia.

(such as sardine, sprat, anchovy, and mackerel) compose about three-fourths the commercial catch. About 85 percent of these blue fish are canned; the rest are salted or consumed fresh.

Shoreline and Bank Area

This area includes the waters adjacent to the mainland of Yugoslavia, the islands, and the reefs. It makes up only one-thirtieth of the eastern half of the Adriatic (the other half is adjacent to Italy) but yields one-fifth the catch. It is by far the most varied region in number of species caught. The dominant fishes are: picarel (Maena spp.), grey mullet (Mugil spp.), dentex (Dentex spp.), bream (Sparidae), pandora (Pagellus erythrinus), salema (Boops salpa), bogue (Boops boops), greater amberjack (Seriola dumerili), leer fish (Lichia amia), wrasse (Labridae), bass (Dicentrarchus labrax), scorpionfish (Scorpaena spp.), corb (Umbrina cirrosa), brown meagre (Corvina nigra), red mullet (Mullus barbatus), striped mullet (Mullus surmuletus), forkbeard (Phycis phycis), comber (Serranus spp.), grouper (Epinephelus guaza), moray (Muraena helena), conger eel (Conger conger), gar-fish (Belone belone), blue damsel fish (Chromis chromis), goby (Gobius spp.), and smelt (Atherine spp.). Also important are the following invertebrates: octopus (Octopus vulgaris), common squid (Loligo vulgaris), cuttlefish (Sepia officinalis), spiny lobster (Palinurus vulgaris), lobster (Homarus vulgaris), spider crab (Maja squinado), common prawn (Palaemon serratus), oyster (Ostrea edulis), mussel (Mytilus galloprovincialis), and date-shell (Lithophaga lithophaga).*

This area offers the most favorable conditions for effective year-round fishing: accessibility, shallow water, and high-quality fish. It is not surprising, therefore, that these grounds have been exploited for thousands of years.

The coastal fishery is a mosaic of different types of gear. Most numerous are nylon gillnets, various drag-nets (set from small boats, then retrieved by hand from the beach), and small beam trawls. In recent years, the use of drag-nets has been greatly curtailed because of the conviction that this gear takes too many immature fish. As drag-nets are phased out, gillnets tend to replace them.

Fig. 2 - Dalmatian fisherman preparing basket-traps. These traps are widely used in Yugoslavia for taking fish and shellfish.

Fishing with basket-traps (fig. 2) is done mostly by islanders, who also use hooks, spears, gillnets, drag-nets, and beam trawls in their subsistence fishery.

The subsistence fishery is the biggest single element of the coastal fishery today. It involves thousands of fishermen--at least a few from every community. Nearly every household has a few fish dinners weekly. Iz Veli, a typical island community, is shown in figure 3.

Sport Fishing

Sport fishing is increasing. In 1962, over 5,000 members were registered in 52 clubs. The number of unregistered sport fishermen was estimated to be twice that large. These fishermen used about 6,000 skiffs, 1,500 underwater spear-guns, 2,500 gillnets, and 300,000 longline hooks. One concerned scientist calculated, on the basis of 1962 statistical

*All scientific and most common names are from Bini (1965). Where common names familiar to U.S. and Canadian readers were needed, the names recommended by the American Fisheries Society (1960) were used.

Fig. 3 - The village of Iz Veli on the island of the same name--a typical island fishing village of Yugoslavia.

data, that each square kilometer in the coastal area had 11 fishermen (professional, subsistence, and sport), 4.6 boats, 12.7 nets, 5 basket-traps, and 1.5 longlines. These figures did not include large numbers of unregistered small nets--especially gillnets. The intensity of sport fishing has probably increased several fold since these calculations were made. Dynamite is now widely (but illegally) used to kill fish.

These data attest the heavy exploitation in the coastal zone. Catch statistics show, furthermore, that some of the most valuable species, red mullet, striped mullet, dentex, bass, bream, scorpionfish, and octopus, are far less abundant today than 100 or even 50 years ago. Less desirable species, such as bogue and other small fishes, make up an increasing percentage of the catch. The young of most important species have legal protection--a minimum body length regulation. The regulation is difficult to enforce, however, and seems largely ineffective.

Trawling Area

This area extending out to depths of 300 meters (the limit for standard Adriatic trawlers) ranks second in size and in the number of species taken. Important are hake (Merluccius merluccius), skate (Raja spp.), sole (Solea spp.), anglerfish (Lophius spp.), gurnard (Trigla spp.), whiting and poor cod (Gadus spp.), John Dory (Zeus faber), dogfish (Squalus spp., Scyliorhinus spp.), smoothhound (Mustelus spp.), angel shark (Squatina spp.), stingray (Dasyatis spp.), picarel, pandora, bream, weever (Trachinus spp.), argentine (Argentina sphyarena), squid, cuttlefish, Norway lobster (Nephrops norvegicus), and spider crab. There are large but as yet unmarketable populations of fan mussel (Pinna nobilis), sea urchin (Echinus spp.), starfish (Antedon mediterranea), and sponge (Geodia spp., Mycale spp.).

The history of exploitation in the trawling area dates to the third and fourth century B.C., when the Greeks had colonies on the present-day Yugoslav coast. Ancient Greek documents show that longlines were used to take fish (chiefly hake, dogfish, and skate) in water down to 100 meters. Trawling with two-boat combinations (pair trawling) in depths to 80 meters began about 200 years ago. Motorized vessels were first used in these pair trawling operations in 1908; modern trawling (with doors) began just after World War I. The number of boats in the trawl fishery has fallen in recent years (from 154 in 1961 to 117 in 1965).

Only about one of every six boats is a full-time trawler. The others divide their fishing time between trawling and other types of fishing--chiefly seining for pelagic fish. The full-time trawlers are smaller vessels (under 100 hp.) built between the two world wars. They operate in the canals between the larger islands but, even there, they are often blown into port by adverse winds and so average only about 150 fishing days per year. Of the larger boats (over 100 hp.) that divide their fishing time between trawling and other types of fishing, only every tenth boat fishes intensively in the open sea areas. The others fish either inside or outside, but not extensively. Crews range from seven to eight men for the larger vessels, upward from 25 m., but are five or less for the smaller boats working in the canals.

Trawlers now take 1,000-1,600 metric tons annually. The main trawling area is the Blitvenica grounds (fig. 1). By agreement, part of this area is allocated to Italian fishermen. The Yugoslavs are reexamining this agreement, however, in light of their own declining catches. (For details, see CFR, July 1969, page 47.)

Open-Water Area

Although this area is by far the largest in terms of sea surface, scarcely one-half of it contains significant fish populations. Furthermore, fish in that one-half are not uniformly distributed: they are fairly abundant on some grounds but scarce in others.

Of the about 200 commercially important species in the Adriatic, only about 14 are found in the open-water area. Yet this small number makes up three-quarters of the commercial catch. Important species are: sardine (Sardina pilchardus), sprat (Clupea sprattus), anchovy (Engraulis encrasicholus), Atlantic mackerel (Scomber scombrus), chub mackerel (Scomber japonicus colias), Atlantic saury (Scomberesox saurus), gar-fish, horse mackerel (Trachurus spp.), bluefin tuna (Thunnus thynnus), Atlantic bonito (Sarda sarda), frigate mackerel (Auxis bisus), little tuna (Euthynnus alletteratus), swordfish (Ziphias gladius), and bogue. These are all schooling fish--some dwell close and others far from shore. A catch of Atlantic mackerel, a popular fish cooked on a grill, is shown in figure 4.

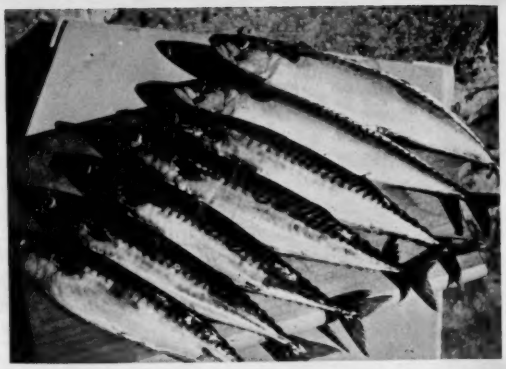


Fig. 4 - Atlantic mackerel, a popular fish, especially when cooked on a grill.

The exploitation of pelagic fish in the Adriatic Sea is centuries old and spans three distinct periods. During the first, before 1929, the fishery was limited to a narrow band near the shore and involved only drag-nets and set-nets. In 1929, the advent of purse seines enabled the fishermen to move farther offshore. The first use of modern fish-detection equipment and radio-telephones in 1953 marked a beginning of the third period--expansion into previously unexploited areas.

In 1968, 416 boats were engaged in seining. These were two basic types. The first, about 170 boats, operated by true professional fishermen, is typically 16-19 (occasionally 20-25) meters long with 80-150 (occasionally 150-240) hp. (fig. 5). Nylon nets used are on the average 350 m. long, 80 m. deep, and are lifted with a winch. The average crew is about nine; the average yearly catch 90-100 metric tons.

Another type of seiner (246 boats) fishes closer to shore, with cotton netting that requires much more maintenance than nylon nets. These boats often fish on stations in narrow local areas where fish are known to occur. Crews are made up of seasonal workers who otherwise work at agricultural jobs; the crews are often twice as large as those of true professional seiners. The average catch is 25-30 metric tons a year. Some beach seines are still used for catching pelagic fish but in decreasing numbers. Special skiffs, outfitted with lights to attract fish schools, are an important part of the pelagic fishing (fig. 6).

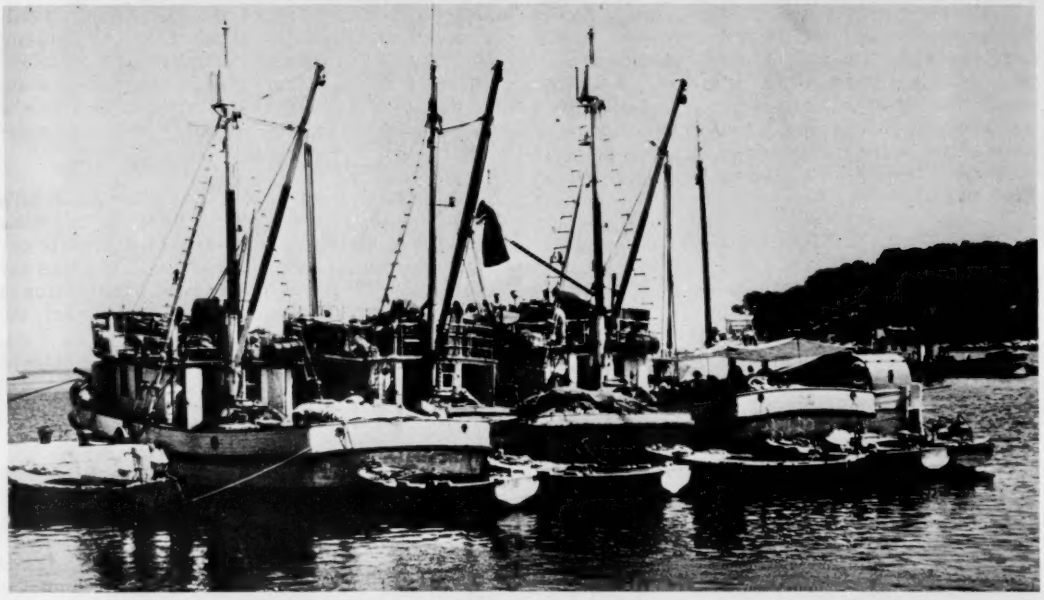


Fig. 5 - Three large purse seiners lying in port. The vessels are the backbone of the Yugoslav fishery for pelagic species.

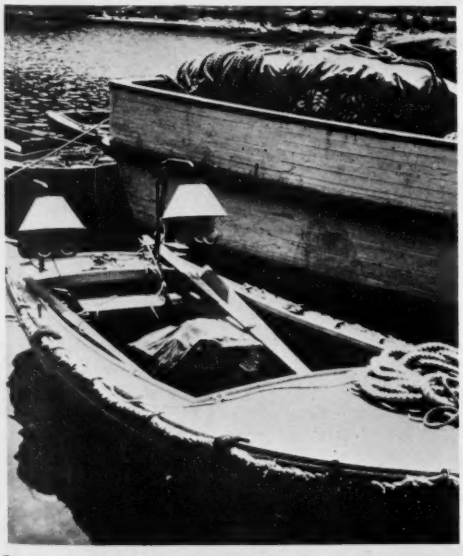


Fig. 6 - A skiff outfitted with lights for attracting pelagic fishes. In 1968 about 4,000 of these units engaged in the Yugoslavia fishery for sardines, sprat, and anchovies, and the other open-water species.

The fishing season lasts 9 months and is confined to areas less than 120 meters deep. Beyond that depth only a rare school of Atlantic saury or tuna are found--never sardines. The catch of pelagic fish has increased steadily from about 9 thousand metric tons in 1955 to 23 thousand tons in 1968; sardines make up 54 percent, mackerel 13.5 percent, sprat 13 percent, anchovies 8 percent, and the others 11.5 percent.

Deep-Water Area

This area in the southern Adriatic is given a special classification because it is farther from shore and deeper than the open-water area. Depths range from 300 to 1,000 meters.

Of the 31 species of fish and shellfish in the deep water area, the most important are hake, stone bass (Polyprion cernium), roughshark (Centrophorus granulosus), sixgill shark (Hexanchus grisseus), blue shark (Carcharias glaucus), rockfish (Sebastes dactyloptera), congor eel, greater forkbeard (Phycis blenniodes), Norway lobster, and shrimp (Aristeomorpha foliacea).

Ninety-five percent of the catch is taken by longlines and the rest by trawls. Little is known about the status of the stocks except that hake are becoming scarcer. Although some marine scientists believe that this area could support a larger fishery, the rigors of conducting a longline fishery at considerable distances from shore have suppressed expansion thus far.

UTILIZATION OF CATCH

In round figures, the total marine catch has increased from 26,000 metric tons in 1965 to 27,000 in 1966 and 30,000 in 1967 and 1968. Most of this increase, however, is from the catch of pelagic fish. The catch of shellfish has increased only slightly, and that of the highly sought demersal or "white" fish (groundfish) has decreased. For the Yugoslav housewife who prefers the "white" fish, the situation is bleak.

First, even within the decreasing catch of groundfish, fewer prime species and more less-desirable species are being caught. Second, to meet skyrocketing demands of expanding Yugoslav tourist industry, hotels and restaurants are buying more and more available prime fish, even before they reach the dock. The result: fewer high-quality fish appear on the public market and these are expensive. Since 1963, in fact, frozen Japanese fish have been imported to meet the demand--a bitter situation, indeed, for coastal people with a great tradition of eating fresh groundfish.

The fish-canning industry has a long history. Even before World War II, Yugoslav sardines in oil and fillets of anchovies were well received on the world market. Immediately after 1945, the canning industry expanded its capacity to 30,000 metric tons annually. This proved to be overexpansion because catches of pelagic fish did not increase accordingly. Despite recent catch increases, from 18,000 metric tons in 1965 to 23,000 in 1968, and the purchase and canning of frozen tuna from Japan's Atlantic Ocean fleet, the industry continues to operate below capacity.

In giving reasons for this less-than-optimum operation, some experts contend that the stocks of pelagic fish already are fished to capacity and no significant reserves exist. Only anchovies, sprat, and saury, they maintain, can support increased fishing effort. Others contend that plenty of fish are available but that high operating costs (fuel, maintenance, and repair) compared to price received for fish simply make increased fishing unattractive. Still others cite difficulties in marketing the canned products on world market.

It is increasingly evident that the Adriatic's fish populations cannot support the vigorous canning industry, let along meet domestic demand for fresh fish. Moreover, skeptics say that to raise per-capita fish consumption to the average European's (15 kg. per year), the catch would have to increase 10 times. This, they feel, cannot be done because the fishery reserves are too limited.

THE FUTURE

The Adriatic Sea, deficient in nutrient salts, is not a productive body. Therefore it is difficult to envision significant expansion of the conventional fisheries. Yet the possibility of increasing production by farming the sea appears tremendous. The Yugoslav coastline is surprisingly extensive. The direct distance from the border with Italy southward to the border with Albania is only 628 km., but the total length of the shoreline of the mainland and islands is 6,106 km. Yugoslavia has one of the most richly indented coasts in Europe.

The possibilities for fish farming and shellfish culture are almost unlimited under such circumstances. Fish production could be increased by rearing high-quality fish (chiefly mullet) in enclosed or semi-enclosed bays, artificially fertilized. Initial studies by Yugoslav marine scientists have proved that such rearing can be successful. The main species of shellfish in the Mediterranean and Adriatic Seas are the mussel and the oyster; the mussel is much easier to rear. Fan mussels, which can be farmed on the sea floor, offer another possibility. From each hectare of suitable ocean floor, it is possible to harvest 50,000 fan mussels annually with more than 8,420 kg. of pure flesh. This yield is better than the amount of meat produced per hectare on much of Yugoslavia's grazing lands.

Through fish farming, the Yugoslavs would like to raise the consumption of fresh seafood from one-half kg. per year--among the lowest in Europe--to 4 kg. per person per year.

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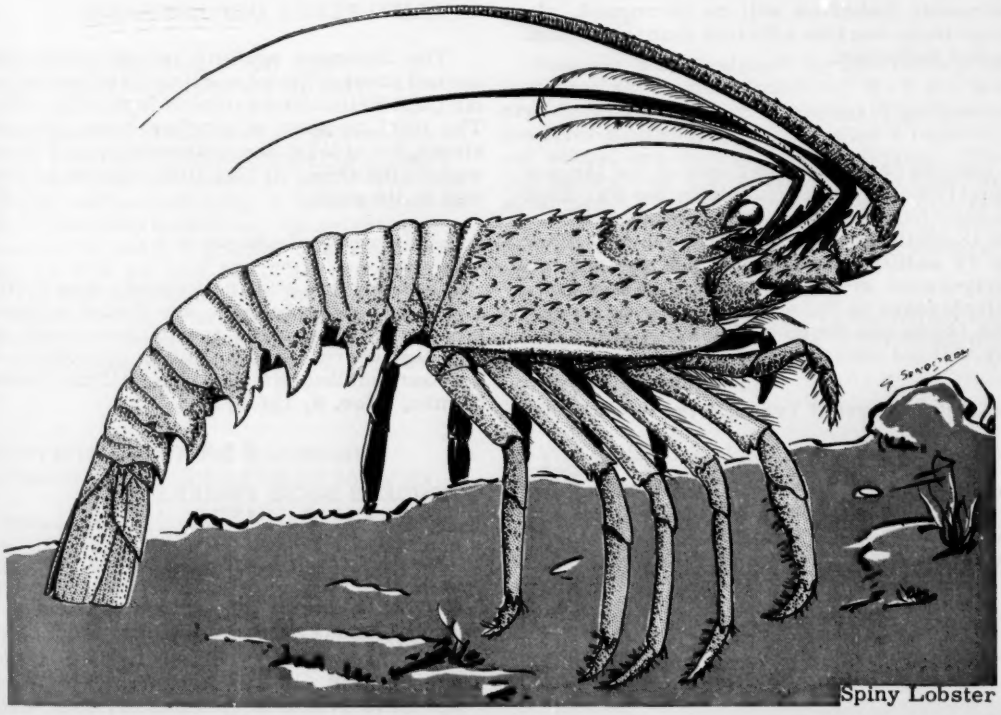

Spiny Lobster

USSR

KAMCHATKA HERRING CATCHES DECLINE

In 1959, Kamchatka's herring catches came from 4 major populations--3 in Bering Sea off Soviet shores, and one in northern Okhotsk Sea. By 1968, the Bering stocks had been completely depleted; only the Okhotsk herring remained. And even the most optimistic predictions give the Okhotsk stocks only 3 years at present fishing intensity. The stocks are fished by 200 vessels from the Kamchatka Fisheries Administration alone.

The Bering Sea fishery off Kamchatka's east coast has been discontinued temporarily, but local 'kolkhozes' reportedly are not equipped to catch other species.

Distant-Water Fleets Blamed

Depletion in the Bering has been blamed on the 'fishery in international waters,' where restrictions set by Soviet scientists are ineffective, and the fishery continues. A leading scientist has said that efforts to expand distant-water fisheries will be increased, although these are less efficient than traditional coastal fisheries.

Processing Plant Idle

Despite depleted stocks, one of the largest Soviet fish-processing plants in the Far East has been built in Kamchatka, on Lavrov Bay. The 12-million-ruble (US$13.2 million) plant has 17 salting shops, and 2,000-metric-ton refrigerated storage capacity. The plant, built contrary to the advice of fishery scientists, is now idle for lack of herring. It probably will not operate for 5 years or more.

Lacks Refrigerated Transports

The Kamchatka fleet also lacks refrigerated transports. In first-half 1969, 25 factory stern trawlers (BMRT) were idled for 217 days waiting to unload catches. ('Literaturnaia Gazeta,' No. 42, Oct. 15, 1969.)

* * *

FISHES SAURY IN NORTHERN BARENTS SEA

Four vessels of the Northern Fisheries Administration (Sevryba) sailed from Murmansk in late September 1969 for the northern Barents Sea. Their mission was to explore for saury around Novaia Zemlia, a large island off Siberia. Catches of 7 to 10 metric tons per vessel per day were reported. This is the farthest north the Soviets have explored for saury.

Pacific Saury Dwindles

According to U.S. scientists, none of the 4 species of saury (Cololabis saira, Scomberosox, and 2 dwarf species) occurs in the area of Novaia Zemlia. If the Soviet claim is true, the attempt to diversify their saury fisheries probably results from dwindling stocks of Pacific saury (Cololabis saira) between USSR's Siberian coasts and Japan. This was discussed recently in meetings of Japanese and Soviet scientists.

* * *

WHALING FLEET OFF HOKKAIDO

The Japanese whaling industry was concerned about a Soviet whaling fleet operating off Cape Erimo (Hokkaido) in Sept.-Oct. 1969. The total number of catcher boats was not known, but at least one mothership and 8 boats were in the area. At that time, sperm whaling was at its peak.

Area Barred to Japanese

The Japanese whaling industry was having a difficult time because the Soviet motherships were operating in an area (south of 20° N.) where Japan prohibits operations of her own whaling motherships. ('Shin Suisan Sokuho,' Nov. 6, 1969.)

* * *

CONSIDERS SQUID FISHERY OFF U.S. ATLANTIC COAST

The Atlantic Fisheries and Oceanography Research Institute (ATLANTNIRO) analyzed 3,420 hauls during 24 exploratory and research cruises between 1958 and 1968 from

USSR (Contd.):

Cape Hatteras, N.C., to Georges Bank. Squid was found distributed widely in the area. A year-round fishery appears possible with seasonal adjustments.

Largest Concentrations

The largest concentrations were found in June-November northeast of Blake Canyon in 50-160 meters. Catches on the southern slopes of Georges Bank averaged 0.5-1 metric ton an hour; peaks were 6 tons. Off Wilmington, Delaware, and Baltimore, Md., catches of 2.5 tons were made in 60-100 meters. In a 30-square-mile area off Wilmington, squid stocks were estimated at 6-7,000 tons.

In December-May, squid concentrate in troughs of the continental slope at 100-220 meters, in water temperatures of 9-12° C. ('Rybnoe Khoziaistvo,' No. 10, 1969.)

Soviet squid catches now are incidental to groundfish catches.

* * *

STUDIES VALUABLE FOOD FISH DISCOVERED OFF HAWAII IN 1967

The Soviets discovered large concentrations of boarfish (Pseudopentaceros richardsoni) northeast of Hawaii in 1967. The fish is 22-31 centimeters long, 7-12 centimeters high, 3-5 centimeters thick. Its weight ranges between 210 and 675 grams. The flesh contains 19-27% oil and 12-17% protein. At -18° C., boarfish can be kept for 1 year without deteriorating. The fillets are suitable for delicatessen items (canned, smoked, salted, etc.). ('Rybnoe Khoziaistvo,' No. 10, 1969.)

* * *

SCIENTISTS DISCOVER MAGNESIUM-METABOLISM REGULATOR IN SALMON

Soviet experiments with Pacific salmon have confirmed the existence of a substance that regulates magnesium metabolism in live organisms.

Any anadromous fish has a mechanism that enables it to withstand either a shortage or excess of magnesium salts. Salmon are known to be particularly sensitive to abrupt fluctuations of the magnesium salt level when migrating downstream to the ocean.

To Continue Experiments

By continuing the experiments with dogs, the scientists hope to identify the organ that produces the substance. Once it has been isolated, it could help prevent or cure disturbances of magnesium metabolism in live organisms. ('Tass,' Nov. 26, 1969.)

* * *

UNDERWATER HABITAT VEHICLE TESTED IN BLACK SEA

The Soviet habitat vehicle 'Sadko-3' was lowered off Sukhumi in the Black Sea to 25 meters in late 1969. The experiment included bio-acoustic research, and tests of activity and physiological condition of 3-man crew. Voices and sounds of marine fish were recorded to use in inducing artificial schooling of fish with similar manmade sounds. If successful, the technique may be introduced commercially.

The Vehicle

Sadko-3 was designed by the Leningrad Hydrometeorological Institute. Its 3 stories are divided into compartments: the first is the diver's compartment; the other 2 (spherical shape) are dwelling compartments. The laboratory, on the outside, has a cagelike structure. This is a metal frame covered with synthetic-fiber net of 300 cubic meters. Species of fish are observed in near-natural conditions.

The biological program is headed by the Chief, Acoustics Institute of USSR Academy of Sciences.

Test Site

The tests took place at marine scientific station of Laboratory for Underwater Research of Leningrad Hydrometeorological Institute at Sukhumi. Specialists from Academy of Sciences and Medicobiological Institute of Public Health Ministry participated. ('Pravda,' Nov. 29, 1969.)

ICELAND

FISHING INDUSTRY IN 1969

'Iceland Review,' No. 4, 1969, reports that 1969 was a good year for cod and other demersal species on Icelandic fishing banks. Both trawlers and smaller boats made good inshore catches. Vessels fishing baby lobsters off the south coast increased. Much of this catch was exported frozen to the U.S., Switzerland, Italy, and Britain. The Greenland turbot fishery off the north and east coasts also increased. The turbot was sold whole-frozen to Europe, and frozen in blocks to the U.S.

Exports

An important contract for canned and smoked saithe was signed with Czechoslovakia. Unusually large quantities of shrimp from the northwest will go to Norway, Sweden, and Denmark. A search for shrimp and shellfish, underway in Faxa Bay, will increase employment opportunities around Reykjavik.

All available salted-fish stocks were sold at fairly good prices, mainly to South Europe.

Whale Meat

The whaling season (late May-late Sept.) produced 423 whales from the Greenland Sea, about average. Much of the meat went to Britain for pet food.

Catch & Utilization

The U.S. Embassy, Reykjavik, reported on Jan. 13, 1970, that preliminary data on Iceland's 1969 fish catch showed 655,246 metric tons (9% over 1968). Value can only be estimated; probably it will be considerably less than in 1964-66, but at least 15% higher than in 1968. (Figures for first three quarters 1969 show an increase value of 25% over the same period 1968.)

The Embassy had reported on December 9, 1969, that institutional, retail, and fish 'n chips trade in the U.S. largely accounted for this greater value. These outlets have developed a booming market for individually packaged Icelandic fillets, primarily cod. Volume and prices of Icelandic cod fillets sold to U.S. are expected to continue increase through 1970.

More Whitefish

Total catch during 1969 improved markedly over 1968 but was comparatively small for the 60's. This is primarily because the huge quantities of herring caught in earlier years are no longer found around Iceland. However, record quantities of higher-valued fish have been caught. Whitefish, mainly cod, amounted to 424,000 metric tons, exceeding the previous record--415,000 tons in 1964. Similarly, the 1969 shrimp and lobster catch was a record 6,000 tons, surpassing the 1963 high of 5,800 tons.

Herring & Capelin

As expected, the 1969 herring catch was minimal--53,000 tons. It dropped about 90,000 tons from 1968. It was about 10% of the 1964 catch and represented an even smaller percentage of 1965 and 1966 catches. This decline was partly offset by an increased catch of relatively lower-valued capelin. This catch establishing a new record kept combined quantity of capelin and herring at the 220,000-ton level.

Table 1 - Fish Catch 1968 and 1969

	Preliminary 1969	1968
	(Metric Tons)	
Groundfish	424,228	373,018
Herring	53,220	142,820
Capelin	171,350	78,166
Shrimp	2,898	2,451
Lobster	3,550	2,489
Other	n.a.	2,416
Total	655,246	601,360

Table 2 - Utilization of Fish Catch 1968 and 1969 *

	Preliminary 1969	1968
	(Metric Tons)	
Groundfish:		
For freezing	249,227	202,237
For salting	83,335	115,178
For drying	45,562	15,174
Landed abroad on ice	35,681	28,812
Herring:		
For salting	19,400	28,834
For freezing	2,800	7,776
For reduction	5,800	55,712
Landed abroad on ice	25,220	49,204
Capelin:		
For reduction	168,950	76,919
For freezing	2,400	1,248
Lobster and Shrimp:		
For freezing	6,348	4,825

* * *

ICELAND (Contd.):

FISHERMEN'S STRIKE AVERTED

Representatives of seamen's unions and fishing-vessel owners have agreed on the distribution of income from fish catches. This probably has averted a strike that could have crippled the country's economy. The fishermen had demanded a higher percentage. Final agreement was signed subject to two conditions: a change in the law on proportion for each party, and increased fish prices.

Under legislation passed in late 1968, 27% of the sales revenue from cod and other white fish catches had been reserved for vessel owner-operators (10% for escrow-type fund for new capital expenditures and debt repayments; 17% to defray an anticipated increase in operating costs due to the Nov. 1968 devaluation). This left only 73% of the white fish to be divided between labor and ship operators, usually 41% to 42% to the fishermen, and 58-59% to the owners-operators. Under the new agreement, the government must change the legislation, reducing initial amount given to owners from 27 to 21%. This will leave 79% to be divided among fishermen.

Increased Prices

The second condition was met when the Fisheries Price Board increased by 9.5% the fixed price of cod and other white fish to the processing plants. Boat owners and fishermen's representatives on the Fisheries Board voted in favor of the increase. Representatives of the processing plants voted against it.

Results of Agreement

According to the press, overall benefit to fishermen will be about a 15% increase in income over 1969, assuming comparable catches. The agreement must be approved by individual unions. An important fishermen's union in the Westmann Islands already has rejected contract. Union members said they would negotiate their own agreement.

Significance of Higher Prices

The 9.5% hike in white-fish price already in effect for 1970 is expected to be extended to herring and capelin. Because landed price is only a fraction of the price of processed fish sold abroad, this action probably will not affect the processing industry's foreign-market position. The effect of the 9.5% increase is similar to the effect of an increase in wheat prices on the consumer price for bread. In fact, the steady price rise in the U.S. during 1969 for frozen cod blocks (from 21 cents to 24 cents per lb.) may well have set the stage for the increase. Iceland's landed price for prime cod is to be raised from 3.25 U.S. cents to 3.56 cents a lb. (prime cod is 19 or more inches long, large, gutted with head, and class 1A quality).

Since the 9.5% increase was already overdue, it is not considered an impediment to the fish-processing industry. The fishermen are not obtaining higher wages; they are only recouping what they lost during 1967-68 when fish prices declined.

Domestic Supply Assured

Another perspective is the relationship of the Icelandic price to prices prevailing in other countries for unprocessed fish. Icelandic vessels tend to land their catch abroad to benefit from higher prices (mainly in Great Britain and West Germany) this became a real problem during second-half 1969. Although a higher price level will eat into the fish-processing industry, profits will, at the same time insure a continuing supply. (U.S. Embassy, Reykjavik, Jan. 9, 1970.)

NORWAY

PURSE-SEINE FLEET LOSING PROFIT

Norway's purse-seine fleet is caught in a profit squeeze despite its modernity and great mobility. Profit data for 1968 showed a loss for smaller seiners, balanced operations for middle-size vessels, and some surplus for large seiners. Incomplete 1969 data show no improvement.

Too Many Vessels

The fleet may be overbuilt, a development forecast previously, and a chronic problem in many of world's fisheries. The future appears bleak because the herring resource and some related fisheries are diminishing. Present fleet is 400 vessels worth US$150 million. Fisheries Department spokesman say 300 would be adequate. Pressure is being exerted on the government to prohibit fleet expansion.

NORWAY (Contd.):

As a result, the Government Fisheries Bank no longer issues loans to purse-seiners. (Reg. Fish. Attaché, Copenhagen, Dec. 1, 1969.)

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NORDIC GROUP TO ENTER MORE EXPORT MARKETS

During 1969, Nordic Group (Norwegian fillet export organization) doubled its frozen fish fillet exports to the U.S. The organization now plans to request rights to enter all other export markets for fish fillets.

Expanding Market

Nordic Group's chairman said that assertions of catastrophe, made when the group first began exporting to the U.S., have proved groundless. Experience showed the Group's exports did not interfere with other exporters. In fact, Frionor is said to have increased its exports 100% since Nordic Group obtained an export license. This showed the market can accommodate all--Nordic Group, Frionor, and Findus. The chairman also contended that more Norwegian products would only stimulate sales. Nordic Group forecast 1969 exports to the U.S. worth about US$5.7 million. ('Fiskaren,' Nov. 10, 1969.)

SWEDEN

GOVERNMENT AIDED FISHING INDUSTRY IN 1969

The Swedish Government aided the fishing industry in 1969 because of the adverse effects of price developments and rising imports. Over US$240,000 was spent for advertising and promoting fishery products, $2.8 million was made available for fishery loans, and $600,000 assisted fishermen transferring to other employment. ('Dansk Fiskeritidende,' Nov. 7, 1969.)

DENMARK

FIRM TO INVEST IN PERU FISH-MEAL FACTORY

Atlas A/S, Denmark, will invest US$2.7 million in a complete fish-meal plant in northern Peru. The plant will have pipelines running from floating pumping stations to the plant, storage pits, cooking equipment for sterilization and coagulation, double screw-presses, rotary drying ovens, mills and sacking machinery.

Marketing Areas

Atlas' most important markets are South and Central America, the USSR, and Japan. The firm also has begun market investigations in North Africa. Morocco, for example, is interested in increased fish-meal production. (Reg. Fish. Attaché, Copenhagen.)

UNITED KINGDOM

DECLINE OF FISH SUPPLIES FORECAST

Britain's White Fish Authority (WFA) has forecast a drop of 7 to 12 percent in 1970 fish landings at British ports from 1968 figures. Imports of fresh and frozen fish also are expected to fall. WFA estimates that 1970 landings of fresh fish from distant-water vessels will be down 20% from 1968. In 1968, this fleet provided about one-third the fish landed by British vessels.

Catch Rates

WFA says catch rates on fishing grounds exploited by Britain's major suppliers--Norway, Denmark and Iceland--will be at about 1968 level. But the fall in 1970 catch rates on most North Atlantic grounds will reduce overall level of supplies.

Imports

It is highly probable that total volume of 1970 imports will be lower than in 1968's. Their level will be determined to some extent by international prices.

Prices to Rise

WFA concluded that since total supplies of fish will be lower in 1970 than in 1968, prices are likely to rise. ('Fishing News,' Dec. 26, 1969.)

LATIN AMERICA

CUBA

THE FISHING INDUSTRY

The following information comes from "The Fishing Industry in Cuba," published by the National Institute of Fishing, Havana, in Nov. 1969.

Cuba's National Institute of Fishing directs and conducts fishing. It has 4 fleets: the Cuban, Caribbean Shrimp, Gulf, and Coastal (including former fishing cooperatives). It includes the Exportadora del Caribe export enterprise, Cuba-pesca enterprise for importing fishing equipment, Victoria de Girón docks, Fishing Research Center, Fishing Port of Havana, Fish Culture Department, and plants for processing fish and other seafoods.

In 1958, the last year before Castro, Cuban fishermen brought in 21,900 metric tons of fish. In 1968, 66,032 metric tons were caught. The Institute "envisages" almost 175,000 metric tons for 1970.

Before Revolution

In 1959, there were a few thousand fishermen with about 3,000 boats.[1/] More than 90% of these boats were less than 33 feet long. About 2,000 were 10 to 24 feet, usually sailed by one or two men using primitive fishing techniques. Fishermen, dependent on middlemen and shipbuilders, lived a hand-to-mouth existence. Most fishermen engaged in coastal fishing. Only a few boats fished the open sea--the Gulf of Mexico. None of these was over 80 feet long. Almost all were sailboats with auxiliary engines. All lacked modern equipment needed to increase their catches.

Today, Cuba's national fishing industry is equipped with "modern steel boats, trawlers, and tuna boats that sail distant seas. . . . Modern fishmeal plants, fishing ports, docks, dry docks and other installations are being built." So too are fishing schools to train thousands of young people in modern techniques.

High Fish Consumption

At present, per-capita fish consumption is more than double the pre-Revolution figure.[2/] Before Castro, most fish, except that for export, was sold in Havana where purchasing power was "disproportionally great." In interior cities, small towns, and villages, fish was never a staple because "the people there could not learn to consume a kind of food that was practically nonexistent as far as they were concerned."

Now, the catch of the Coastal Fleet fishing enterprises and cooperatives based in each province is distributed within that province. Also, thousands of tons are shipped every year from Havana, where new, steel-hulled fleets are based, to the interior. Towns and villages "receive proportionately more fish and fish products than before."

The Coastal Fleet

After the Revolution, the fishermen were grouped into cooperatives, granted credit, and provided with equipment, supplies, and technical aid. Modern towns were built for fishermen, who had been living in shacks, near seaport cities of Manzanillo, Caibarién, and Pilón. The price of fish was raised substantially and, "more important, stabilized." In 1966, the National Institute of Fishing created an agency to operate the Coastal Fleet. This was "foundation for a more adequate exploitation of the rich inshore fishing areas."

Today, the fishermen's standard of living has risen over 150%. Illiteracy has been eliminated. Many are pursuing technological and administrative studies at intermediate level.

In 1968, the Coastal Fleet caught 35,875 metric tons of fish and shellfish--54.3% of the total Cuban catch.

The Cuban Fishing Fleet

To conduct open-sea fishing, steel-hulled, deeper-draft vessels were added. Fishermen

1/The last official Cuban census in 1954 tallied 12,900 fishermen--one half in provinces of Havana and Las Villas. This number probably did not change appreciably by 1959. (Milan Kravanja, BCF, Office of Foreign Fisheries.)

2/Despite claims of doubling consumption of fishery products, the effect on food situation is negligible. Long lines still form in front of state-owned Havana restaurants, which have less to offer than even a few years ago, travelers report. The regular daily menu consists of macaroni or pizza with tomato sauce and some cheese. Only rarely are fish dishes available; shellfish never. The total absence of lobsters and shrimp on domestic markets is due mainly to heavy emphasis on shellfish exports to earn much-needed hard currency. Availability was severely reduced by a 50% decrease in sugar exports. It is not known how the Cubans figure fishery product consumption. (Milan Kravanja)

CUBA (Contd.):

were trained to handle larger vessels and fishing equipment--the longline and trawl net. They were trained aboard vessels that were prototypes of the fishing fleet. Those young men have become the captains and officers of new, modern, far-ranging vessels.

The Cuban Fishing Fleet was born in 1962. In that year, it caught only 6.1% of total catch. In 1968, when total gross tonnage had reached 29,758 tons, its catch was 33% of total.

The Cuban Fishing Fleet now has 52 vessels: 3 motherships; 24 tuna boats; 11 side trawlers; 10 stern trawlers; and 4 Victoria-type Cuban-built vessels. It can also use several other Cuban-built steel-hulled vessels. It operates in international waters of North Atlantic, South and Central Atlantic, Caribbean, and Gulf of Mexico.

The Caribbean Shrimp Fleet

Created in 1968, the Fleet has 90 steel-hulled, 76-foot-long vessels with hold capacity of 30 metric tons. These were built in Spain in Bilbao, Santander, Gijon, and Vigo. Construction of 30 French-built refrigerator shrimp boats is scheduled for completion in first-quarter 1970. These are 82-foot-long steel-hulled vessels. They have capacity of 50 metric tons of frozen shrimp, can freeze 5 metric tons daily, and are equipped with cold-water tanks with capacity of 1.84 metric tons. Processing and packing aboard vessels will make it possible for finished product to reach ports "in top condition." The fleet also has several Cuban-built steel-hulled trawlers.

Operational plans for 1970 include 300 trawlers fishing on insular shelf, Gulf of Mexico, and near Honduras and Guyana. Cuba expects these modern trawlers to bring in 10,000 metric tons of shrimp in 1970--and 60,000 metric tons of fish will be caught along with shrimp and turned into fish meal. The boats will operate out of Cienfuegos Bay, "where docks, packing houses, machine shops, an ice plant, a fish meal plant and several warehouses will be built."

The Gulf Fleet

The Gulf Fleet has operated since 1963, mainly in Gulf of Mexico waters. In 1968, it brought in 11% of the total catch. It has Cuban-built wooden vessels 60 to 75 feet long, fitted with latest mechanical, electrical, and electronic equipment.

The fishing gear used most are longlines (for grouper) and trawl net (for shrimp). The Lambda-type grouper boats made in Cuba (most are this type) have up to 6 self-propelled auxiliary boats. The auxiliaries are lowered into sea and brought aboard by hydraulic cranes. Each boat is manned by 2 men. These boats fish the Yucatan Channel and Campeche Bank. The species most frequently caught are grouper, kingfish, and red snapper.

The Gulf Fleet also has 40 Lambda-type boats converted into shrimp trawlers. These operate on Continental Shelf and Gulf of Mexico.

The Fishing Port of Havana

The port processes fish caught by Cuban Fishing Fleet and services and repairs fishing vessels.

The 34-acre port, which cost 35 million pesos, was built by Soviet specialists under a 1962 technical assistance agreement. It has 8 refrigeration storerooms with total capacity of 11,500 tons of fish. An ice plant can produce 40 tons of ice a day. A floating dry dock can handle ships up to 2,500 tons displacement.

"Other installations include repair shops, supply storerooms, power substations, steam boiler rooms, air compressor rooms, more than 100 pieces of heavy equipment (gantry cranes, fork lifts, motorized warehouse trucks, etc.), a radio communications plant, a fish meal plant with a capacity of 90 metric tons of raw material per day and an oxygen plant."

The facilities are being expanded with new docks, boats, tugs, barges, and storage depot.

Experience in Ship Building

Prior to 1959, ship building was limited to a few boats for sponge fishing, dinghies and other small craft for fishing in Gulf of Mexico. There were no large shipyards on the island. The few boats were built in shipyards on river banks or beaches for easy launching.

By 1961, however, there were several shipyards building small fishing vessels for Cuban use. "This marked the birth of the Cardenas,

CUBA (Contd.):

Victoria, Cayo Largo, Lambda, Sigma, Eta, Omicron, Ro and other types of small and medium-sized boats."

Over 500 wooden vessels between 27 and 122 feet long have been built in Cuban shipyards. Cayo Largo-type boats have been built for lobster, bonito, and sponge fishing; and Doce Leguas-type boats will be used for shrimp fishing on insular shelf.

Construction of steel-hulled vessels has begun. Several have displacement of over 600 tons and will be used to transport shrimp from boats to shore. Also under construction are all-steel shrimp boats, tugboats, and others.

Tests are being conducted on a 50-foot trawler-shrimp boat of reinforced concrete for coastal fishing; a second is being built for lobster fishing.

Fishery Research

The Fisheries Research Center (CIP), at Baracoa Beach in Havana Province, conducts fishery research. This Center has 5 work groups "that carry out research on trawling, tuna fishing, shrimp fishing, lobster fishing and the catching of other marine species (such as oyster, sponges and tortoises). The CIP conducts research in physical and chemical oceanography, plankton and fishing statistics."

Lobster studies include populations in the 4 zones of Cuban Continental Shelf.

Shrimp research also gets special attention: to discover new areas around Cuba and to obtain data on shrimp populations in the rest of the Caribbean and adjacent seas.

Oyster and sponge culture are studied in corrals built by CIP for experiments to increase national production without depleting these resources.

Taking Advantage of Inland Waters

In March 1967, the National Institute of Fishing established the Fish Culture Department with subsidiaries throughout Cuba. This stocks fish and exploits water resources of rivers, natural lakes, and those created by hundreds of dams and reservoirs.

The Fish Culture Department is trying to adapt and raise the Ctenopharyn godon idellus (white amur), Hypophtalmichtys molitrix (white tenca) and several species of carp, and raise bullfrogs, crawfish, and freshwater turtles. It is researching other native Cuban species and ornamental (tropical) fish.

Reservoirs have been stocked with some of these species. "Fingerlings of the so-called American trout have also been included, destined for sports fishing."

JAPANESE TANNER CRAB FISHERY IN EASTERN BERING SEA

Milstead C. Zahn

Japan's two eastern Bering Sea king crab fleets diversified into a full-scale pot fishery for tanner crab (Chionoecetes sp.) in the summer of 1969. This new tanner crab fishery is a timely example of a fishery shifting to meet new demands of economic survival.

The tanner crab resource is not a new discovery. It occupies the same range where king crab has been exploited commercially by the Japanese since 1930. Japanese king crab fleets in the eastern Bering Sea began processing small amounts of tanner crab in 1953. Their production remained at experimental levels, ranging from 170 to 3,457 cases annually until 1964. Early attempts, both foreign and domestic, to extract tanner crab meat from the shell were not competitive with king crab processing then riding the crest of a burgeoning market.

Interest Heightened After 1965

Japanese interest in tanner crab expanded considerably following the 1965 U.S.-Japan King Crab Agreement. That established a quota on the Japanese eastern Bering Sea king crab catch. Emphasis on tanner crab utilization intensified further as king crab catches declined and prices climbed to unacceptable levels in the Japanese market. Tanner crab are retailed primarily as frozen sections and frozen meat in Japan; they find a ready market there with demand and price expected to continue upward.

The response in the Japanese fishing industry to a developing domestic tanner crab market became particularly evident in 1968. Then, in addition to the king crab fleets, several relatively small tanner crab processing ships moved onto the central and eastern Bering Sea grounds. These ships had been fishing tanner crab in the traditional ground near Olyutorskiy Gulf off the Soviet coast. The vessels were diverted 700-800 miles to the southeast and became the first serious commercial effort on the eastern Bering Sea tanner crab stocks. Typically 500-1200 gross tons and employing 35-50 men, they fished exclusively with crab pots. The smaller vessels handled all phases--from pot handling through cooking and freezing. The larger ships were accompanied by pot-setting boats of 80 gross tons. Crab butchering and cooking was done on the weather deck of all these processing ships. These expeditions fished some large U.S.-type king crab pots, but emphasis centered on smaller conical pots rigged several to a groundline.

Mothership Fleets in 1967

During summer 1967, Japan's two mothership-based, king-crab tangle-net fleets began limited use of tanner crab pots though the traditional tangle gear takes five times more tanner than king crab in some areas. Use of pots by the mothership fleets further increased in 1968. By 1969, the two mothership fleets in Bristol Bay used tangle nets and conical pots in nearly equal ratio, and pot use is expected to increase next season. All tanner crab effort in 1969 was incorporated with the two traditional king-crab tangle-net fleet operations.

The Grounds

In general, Japan's expanding tanner crab fishery shares a common season and area with the traditional king crab operations. The eastern Bering Sea crab grounds encompass most of the Bristol Bay "flats" on the Continental Shelf area north of the Alaska Peninsula to Cape Newenham and west to about 175° W. longitude. The extensive Bering Sea Continental Shelf connects Alaska and the Soviet Union on the southern approaches to Bering Strait, and thence northward. It provides a remarkably uniform bottom at depths generally between 30 to 50 fathoms--extending from the Alaska Peninsula west and north to Siberia. Within about 50 miles of the Shelf edge, or 100-fathom curve, the ocean floor falls gradually through 70 and 80 fathoms.

Mr. Zahn is Fisheries Management Agent, BCF, Office of Enforcement and Surveillance, Kodiak, Alaska.

Tanner Processors Before 1969

Prior to 1969, the small tanner processors fished productively in 60-70 fathoms along the Shelf edge between Cape Olyutorskiy (Siberia) and the Pribilofs, as well as on the Shelf near the Pribilofs. The 1969 effort was limited to north of the Alaska Peninsula and near the Pribilof Islands (fig. 1). Fishing began in March with the fleets first working some 20-30 miles offshore north of Unimak Island to as far northeast as off Port Moller. About early May, the effort shifted west to near the Pribilofs. By mid-June, the fishery had returned to north of the Alaska Peninsula. Generally, quotas are filled and the fleets bound for Japan sometime in September or early October.

case of 48 half-pound cans. The Bristol Bay tanner crab have a higher market value, apparently because of larger size, than those caught on the western side of the Bering Sea. Reportedly, the Japanese industry considers crab of $3\frac{1}{2}$ inch carapace width to be commercially usable, though U.S. observers have noted that crab less than $4\frac{1}{2}$ inches are seldom used. Because females are small, they are not retained in commercial operations.

Factoryships in E. Bering

Current Japanese crab effort in the eastern Bering Sea is centered around two 7,500-ton factory ships, each carrying 4-6 forty-

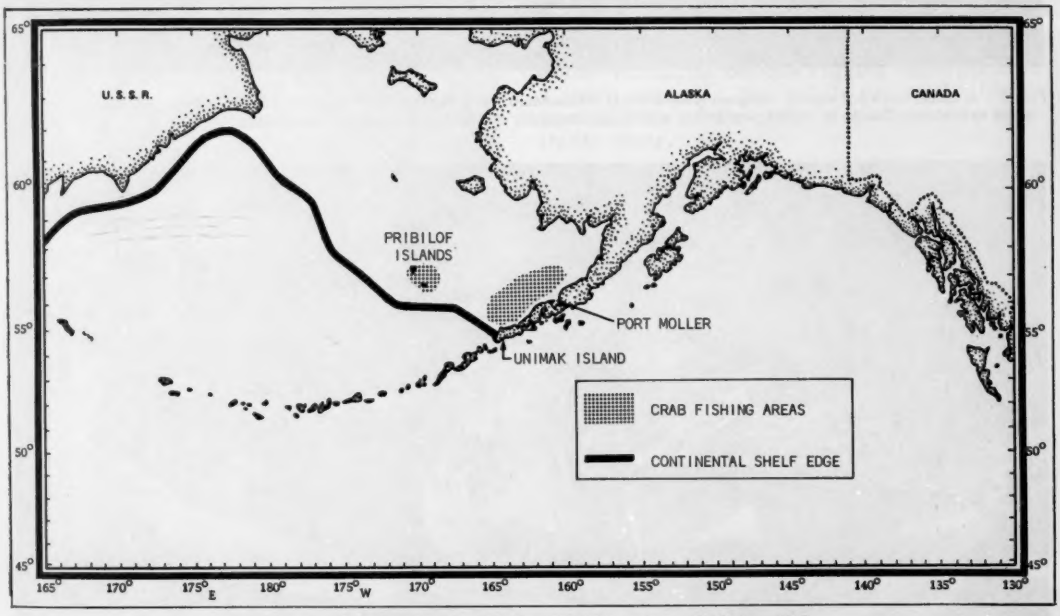


Fig. 1 - Japanese tanner and king crab fishing areas off Alaska, 1969.

Between 1966 and 1969, the Japanese tanner crab catch east of 175° W. longitude in the Bering Sea increased elevenfold--from 1.5 million crab in 1966 to 8.6 million in 1967, 12 million in 1968, and 17.6 million crab in 1969. The 1969 catch exceeded the anticipated 16 million crab by 1.6 million. Crab size varies between areas, but an average of 150 tanner crab is required for one

foot kawasaki boats. The kawasaki boats are used primarily for retrieving tangle nets; on occasion, they work pots. Other accompanying vessels, clippers or small trawlers in the 80- to 150-ton category, were increased from 6 per factory ship to 15 or more in 1969. These larger vessels are responsible for setting net fields and pot gear, and for retrieving pots and some tangle gear.

Fig. 2 - A tanner crab pot vessel, assigned to mothership 'Keiko Maru,' sets gear north of Unimak Island. A buoy and flag are visible going over stern. Stacks of nested pots are on well deck, and fully assembled pots are on fantail.

Fig. 3 - Aerial view of Japanese vessel handling tanner crab pots. Crab are visible stowed in sling loads on well deck. Longlines that carry the pots are coiled on fantail, with nested pots stored to one side.

Lightweight Pots on Longline

Since at least 1965, Japanese fishermen have experimented with pot fishing for king and tanner crab in the Bering Sea. Large king crab pots, patterned on U.S. models, have proved unacceptable thus far. Highly successful, however, are lightweight pots for tanner crab fished on a longline. They are designed to take tanner crab and are selective of that species. Basic design resembles a top-entry beehive shape. Framework is $\frac{3}{8}$-inch black iron rod, except the bottom frame of $\frac{1}{2}$-inch stock wrapped with rope to reduce chafing. The circular base is 45 inches in diameter and the circular top 28 inches across. Top, middle, and bottom frames are welded to straight rods to form a structure 22 inches high. This framework is covered with 6-inch, stretched measure, synthetic fiber web. Some variation in mesh size and frame size occurs. The web bottom of the pot opens for dumping crab. Then it is easily closed by puckering with a drawstring arrangement that secures by means of a hook and stout rubber band. The entry tunnel, hanging vertically from the web top, is a sheet of white plastic sewn into a tunnel 20 inches wide; this tapers to 14 inches diameter and 8 inches long. The complete pot weighs about 40 pounds.

Fig. 4 - Tanner crab pot used by Japanese fleets in Bering Sea. Attached to anchored ground lines, about 1 mile long, these pots are highly selective for tanner crab.

Fishing The Pots

Each pot is rigged with bridle and a 4-fathom gangion ending in an eye splice. Bridles usually are knotted to the top frame in two places, so the pot hangs vertically. Some variation on this rigging incorporates a third piece in the bridle secured midway on the side of the pot. Most lines are synthetic fiber.

Due to ease of handling, pots can be stacked on deck in a ready-to-fish condition. Completely releasing the bottom drawstring, however, permits such efficient nesting that a stack of 30 pots is only 6 to $6\frac{1}{2}$ feet high. A common sight on the fishing grounds is a pot boat carrying hundreds of pots, stacked on all available deck space, so the original ship profile is unrecognizable.

A typical gear arrangement in the Bering Sea is 128 pots on a 3,200-meter groundline. Longlines are anchored and buoyed with glass floats and flagged poles similar to tangle net

Fig. 5 - Japanese crab factory ship 'Keiko Maru,' one of two motherships supporting crab fleets in eastern Bering Sea. Both king and tanner crab are processed on board.

Fig. 6 - A Japanese ship, about 90 feet long, retrieves tanner crab pots. Groundline comes aboard over power roller at starboard rail. (Photos: M. C. Zahn)

gear. Flag code indicates either tangle net or pot string. Both types of gear are set parallel to each other, and as close as one-fourth mile. Gear strings in the eastern Bering Sea are set on a northwest/southeast direction. The longline is retrieved over a power roller at the starboard rail of the well deck, although some boats are rigged for port hauling. There is some variation in handling gear as it comes aboard. In one method, the pot is emptied on deck, and then is baited and reset without detaching from the longline. In other cases, the pots are hand carried to the fantail for stacking, and the longline passed aft and coiled in separate piles. Pots on the stern work areas usually are nested in tight groups on their sides rather than in vertical stacks, apparently for ease of handling during setting. A platform on the stern facilitates setting gear with strings of pots being set at about 5 knots. Crab on board pot boats are stored in sling loads on deck to facilitate delivery to the mothership, generally within 24 hours. Catches, frequently dead but in good condition, are unloaded day and night with delivery and turn-around taking less than one-half hour.

Herring Bait

The usual bait is herring and herring waste placed in small perforated plastic containers of about $\frac{1}{2}$-cup capacity. Three bait containers are placed in each pot. Another successful bait has been Pacific cod (Gadus macrocephalus) used as hanging bait. Pot strings, normally, are fished for 2- to 4-day soaks. Pot success, with seasonal and area variations, has ranged from 12 to 17 crab per pot.

The two species of tanner crab (Chionoecetes [bairdi and opilio]) in the Bering Sea pack are not differentiated in processing. They are marketed in Japan simply as "zuwaigani" (tanner crab). After cooking, most of the meat is frozen, and less than one-third of the pack is canned. The final frozen product varies from legs with shell on to flake meat and leg meat segments. By 1969, large tanner crab legs were retailing for as much as 14 cents each in Japanese markets. Recent use of clear plastic shrink packs, before freezing, has increased market value. It was being considered for larger use in 1970.

JAPAN

TUNA INDUSTRY BESET BY HIGH PRICES

In December 1969, Japanese packers were finding raw material costs rising faster than canned tuna prices. Export sales prices to the U.S. for canned tuna in brine had risen to record highs. So too had canned tuna in oil for export to Europe. But foreign market prices had not increased sufficiently to enable packers to keep up with rising raw material costs. For example, while foreign market prices for canned tuna had increased 10%, raw material costs to packers had increased around 30%; their sales prices rose about 20%.

Raw Material Prices

Dockside prices in Japan were averaging around US$580 a short ton for albacore, $365 a ton for skipjack, and $328 for small skipjack. Even at those prices, most albacore was bought by cold storage operators. The demand for skipjack, from 'katsuobushi' (dried skipjack loin) processors, was so strong that very little, if any, was available to packers. The sharp increases in raw material costs compelled packers to reduce production and sales.

Trading Firms Squeezed

Trading firms faced higher prices of the Sales Company and slower foreign price increases. In addition, the firms were caught in a cost-price squeeze. Since the strong demand abroad had sharply reduced the Sales Company's holding, the firms were forced to pay the packer's asking price to make shipments.

December Quotations

The Sales Company's December 1969 price quotations, 7-oz. 48's, per case: in brine--white meat solid, $12.31; light meat solid, $9.56; in oil: white meat solid, $12.08-12.22; light meat Grade A, $9.86-10.00; light meat Grade B, $9.44-9.58.1/

Exports Weakened

The high prices for oil-pack sharply cut purchases from foreign countries. Their buyers switched from Grade A to Grade B packs, and from skipjack to lower-priced big-eyed.

1/Ex-warehouse, Shimizu, Japan.

The major trading firms were not exerting their usual effort to promote canned tuna exports. Since production increase by packers did not look hopefu in view of the raw material situation, the trading firms were hopeful to hold on to their outlets without losing money. Thus, the price increase was weakening Japan's international competitiveness. Local opinion is that trading firms may profit in the long run by concentrating on domestic market, where food prices are rising. ('Suisan Tsushin,' Dec. 1, 1969.)

* * *

FINDS SAURY ABUNDANT OFF U.S. WEST COAST

Five vessels exploring for saury off U.S. and Canadian west coasts ended operations in late November 1969. The survey established a production potential.

Now the question is how the resource can be harvested most efficiently for the Japanese market. The exploratory vessels fished with stick-held dip nets, but volume production would require a mothership fleet with a freezership.

The Saury

The saury were medium size, averaging around 140 fish a 10-kilogram (22 pounds) container, and "characterized by the absence of fat."

Survey Area

The exploration began east of 170° E. worked east toward the U.S. coast, surveying the area between 52° N. and 39° S. latitudes.

The Vessels

In late July 1969, Taiyo's 'Azuma Maru No. 6' (238 gross tons) conducted a brief survey off California, then proceeded to tuna grounds off Mexico. Nihon Suisan's 'Shinano Maru' (539 gross tons) returned to Japan with about 150 metric tons of saury in late October.

Nichiro's 'Akebono Maru Nos. 17 & 21' (499 gross tons each), and No. 18 (492 gross tons), had taken over 300 tons by mid-November. They terminated operations at month's end.

JAPAN (Contd.):

Plans for 1970

Operations in 1970 and after will depend on the saury fishery off Japan. Japanese and Soviet scientists have predicted a good saury season off Japan in 1970. ('Suisancho Nippo,' Nov. 25, 1969.)

* * *

NEW SAURY NET TESTED

'Tenyu Maru No. 37' (499 gross tons) sailed for the eastern Pacific recently on a saury fishing expedition. She was equipped with a special rigging for distant-water operations.

Tests in Okhotsk & Pacific

She used the new gear, a 'light-using surrounding lift net,' successfully in the herring gillnet fishery in the Okhotsk Sea off Kamchatka. Now she is trying it out in the eastern Pacific. No details of the gear's construction or rigging have been disclosed. Reportedly, its design was based on saury-migration data in the eastern Pacific.

Portable Design

The vessel probably will use a surround net, encircle saury attracted by lights, and haul them aboard by pump. Its performance will be followed closely in Japan. ('Suisan Keizai Shimbun,' Dec. 2, 1969.)

* * *

INVESTIGATES CHILEAN FISHERY RESOURCES

The Japan Fisheries Association plans a 3-year cooperative fishery-resource investigation in Chile to develop a centolla crab fishery and a salmon hatchery program.

The Association will send 8 fishery specialists in the first year (fiscal 1969 ending March 1970). Four left Japan on Nov. 18, 1969, for a 70-day crab survey. Four others were slated to leave December 16 for a 4-month salmon hatchery study.

Financing

The Association's budget for the first 2 years is US$63,000--$48,000 for crab investigations, and $14,400 for salmon. Half the cost will be subsidized by the Japanese government; the rest will be financed by major fishery firms and a fishermen's organization. The 3rd year budget will depend on findings in the first 2 years.

Resource Search

Japan proposed the survey on basis of available data--and on assumption that fishery resources were as abundant south of 40° S. latitude as in the Bering Sea and the North Atlantic. Chile was selected because of its geographic location and its favorable attitude toward Japan. ('Suisan Tsushin,' Dec. 12, 1969.)

* * *

SURVEYS SHRIMP FOR YEMEN

In cooperation with the Food and Agriculture Organization (FAO) program for developing countries, a Japanese company will conduct a 2-year survey of shrimp fishing off south Yemen. FAO has charted a vessel, 'Nisshin Maru No. 52' (100 gross tons), for the work.

The Japanese may increase the number of vessels in the future and establish a joint venture with Yemen. ('Shin Suisan Sokuho.')

* * *

FISH UTILIZATION IS CHANGING

Of Japan's total marine catch (excluding whales) of 7.85 million metric tons in 1967, 68% was utilized in producing processed products, and 32% was marketed fresh or frozen. Among processed products, kneaded 'kamaboko' (fish cake) and sausages took 24% of total catch; salted and dried, 23%; oil, meal, and inedible items, 13%; and canned, 8%.

In recent years usage of fishery products has changed greatly due to rising incomes and changing diet. ('Japan Fisheries Yearbook,' 1969.)

* * *

PLANS 1970 HERRING FISHERY OFF SOVIET COASTS

In 1969, the Japanese Fishery Agency accepted 232 applications for 1970 herring fishing licenses. They included 218 vessels that actually fished in 1969. The new licenses are to be issued in May 1970.

JAPAN (Contd.):

Fishery Poor in 1968

Because of the 1969 herring catch--about 26,000 metric tons off Cape Okhotsk (West Kamchatka) and poor yields in the Olyutorskii Cape area--the number of Japanese herring vessels allowed to fish the Olyutorskii area probably will be reduced considerably in 1970. ('Shin Suisan Sokuho,' Nov. 1, 1969.)

* * *

EXPORTS OF CANNED TUNA IN OIL FELL IN 1969

Jan.-Oct. 1969 exports of canned tuna in oil totaled 7,821,675 kilograms valued at US$7,528,000, down 3,926,865 kilograms and $2,127,000 from same period 1968. Most of the decline was due to sharply reduced exports to West Germany. The latter's purchases were 63% below the 1968 period, primarily because of increased prices. ('Katsuo-maguro Tsushin,' Dec. 3, 1969.)

* * *

CANNED MACKEREL EXPORTS AND PRICES RISE

December 1969 prices for canned mackerel exports to the U.S. were c. & f. US$6.30-6.50 a case for natural 1-lb. tall 48's, about 30 cents over November's high of $6.20. Prices for mackerel canned in tomato sauce rose about 55 cents a case. The price increases were attributed to active buying when production declined because of sharply reduced landings and rising dockside prices.

Stronger Export Market

Increased buying was due to a strengthening overseas market. The export market, dull during first-half 1969, began picking up in second half. Canned mackerel exports in 1969 should have exceeded 9 million cases; 7.85 million cases were sold in 1968. ('Suisan Tsushin,' Dec. 16, 1969.)

日本

SOUTH KOREA

WILL EXPORT SAURY TO JAPAN

Songto Fishing Company plans to export Pacific saury to Japan. At 30 metric tons a shipment, price will be around 100 yen a kilogram (US$252 a short ton), duty included (destination Hakata or Shimonoseki, southwest Japan). Songto has a fleet of 6 trawlers (40-100 gross-ton class) and a refrigerated carrier vessel. ('Suisancho Nippo,' Nov. 28, 1969.)

* * *

SHRIMP FISHING IN CARIBBEAN BEGINS

A Mexican shipyard built 5 steel-hulled 380-hp. shrimp trawlers for a South Korean fishery firm during 1969. The 76-foot-long vessels cost US$96,000 each, excluding nets. Korean crews claimed the vessels in August 1969. They will fish shrimp off Guyana.

The shipyard was reported negotiating with the same firm for 10 more shrimp trawlers for spring 1970 delivery. (Reg. Fish. Attaché, Mexico City.)

* * *

TO ADD HUNDREDS OF LONGLINERS IN 1970

South Korea's Office of Fisheries plans to build 450 small longline vessels in 1970. Gross tonnage: 5,500 tons; cost: 1.7 billion won (US$54.7 million); average longliner: 12.2 tons. One hundred vessels will fish puffer; 350 sea eel.

Korean importers of Japanese vessels have been at a disadvantage with Japanese builders following devaluation of the won in Nov. 1969 (from 285 to 305.1 won for US$1). Difficulties in concluding a vessel-import contract for 1970 are expected.

47 Japanese Vessels

From Apr.-Oct. 1969, 47 Japanese-built vessels were licensed for export to S. Korea by Japanese Fisheries Agency: 30 trawlers, 3 purse seiners, 8 tuna longliners, 3 fish carriers, and 3 auxiliary vessels. ('Nihon Suisan Shimbun,' Dec. 10, 1969, and 'Shin Suisan Sokuho,' Oct. 24, 1969.)

SOUTH KOREA (Contd.):

About Puffers

Puffers (family Tetraodontidae) are called that because they react to being pulled from the water by swallowing air and blowing up like a balloon. Their internal organs (sometimes the meat) may contain a deadly poison--tetrodotoxin, which has important medical uses. Despite this, they are a much appreciated food fish, especially in Japan. There, dishes from puffer (fugu) are prepared by cooks required to have a certificate from a licensed "fugu" school. Dishes from improperly prepared puffer can results in acute food poisoning.

TAIWAN

RATIFIES CONTINENTAL SHELF CONVENTION

The Taiwanese Legislature ratified the Convention on the Continental Shelf at its last session in 1969. It was aimed at protecting possible petroleum resources in the Taiwan Straits. ('Minato Shimbun,' Nov. 9, 1969.)

* * *

PLANS 1970 FISHING VESSEL CONSTRUCTION

The Fisheries Bureau has set a target of 33,000 gross tons for 1970 fishing vessel construction. In the past, only tuna longliners have been built; now trawlers are to be included. The Bureau has planned forty 250-ton tunalongliners (financed by an Asian Development Bank loan); two 300-ton trawlers; 4 pairs of 2-boat 200-ton otter trawlers, and three 800-ton high-seas shrimping vessels. (The America-China Fund will provide US$1.5 million.) Several trawlers, or 2-boat otter trawlers, totaling 800 tons will be financed by Taiwan's Agriculture Rehabilitation Corporation.

Reconstruction

The Central Bank of Taiwan will provide US$7.5 million to rebuild a number of draggers (total 4,000 tons) and tuna longliners (4,000 tons). The money also will be used to expand freezing facilities both in Taiwan and at overseas foreign bases; and buy refrigerated trucks. Plans for the remaining 10,400 tons are to be worked out.

1968 Landings

Taiwan's 1968 landings were an all-time record--531,000 metric tons--15.9% over 1967. Growth rate, one of the highest in the world, doubled 1967's 7.7% in 1968. High-seas fishing provided almost one-half the total catch in 1968 compared with 20% in 1956. Total 1968 value of landed fishery products was US$130 million.

The Government's 5-year plan provides for a continuous expansion of fishery landings well into the 1970s. In 1968, the fishing industry came close to the planned 1969 catch (557,000 tons). The 800,000-ton catch planned for 1972 now seems feasible. ('Suisan Keizai,' Nov. 13, 1969.)

1969 Catch

The Fisheries Bureau has announced that during the first 6 months of 1969 the catch was 293,457 metric tons--18.5% higher than during the same period in 1968, and 52.7% of the catch planned for 1969. High-seas fisheries totaled 127,351 tons (up 3.7%), offshore fisheries totaled 132,642 tons (up 24.8%), coastal fisheries 13,588 tons (up 9.1%), and fish culture yielded 19,876 tons (up 17.6%). The tuna catch was 45,776 tons, worth about US$3.9 million (up 20.4%). ('Suisancho Nippo, Sept. 25, 1969.)

THE MARINE FISHERIES OF MOROCCO

Salvatore Di Palma

The waters off Morocco contain rich resources of sardines and other fishes. In 1968, landings totaled 212,920 metric tons--sardines comprised 167,623 tons. Most fish is canned or reduced into meal and oil for export; 1968 exports were 104,000 metric tons worth about $34,200,000. The need for upgrading and expanding the industry is generally recognized. The task has been assigned to the Office National des Pêches created in February 1969. Recent improvement in world market for canned sardines and fish meal augurs well for the near future.

THE RESOURCES

The waters off Morocco's Atlantic Coast from Cape Spartel to Cape Juby are rich in fishery resources. Strong upwellings and oceanic currents favorably influence the fisheries. Sardines (Sardina pilchardus) are the most important stock. Mackerels, anchovies, tuna and tunalike species, horse mackerels, and hake are abundant. Limited but fairly valuable resources of shrimp and lobsters are also present.

The Harbor of Agadir. (FAO/A. Defever)

Mr. Di Palma is Regional Fisheries Attaché for Western Africa, United States Embassy, Abidjan, Ivory Coast.

The Mediterranean waters off the northern coast have limited resources and supply less than 5% of landings.

Official nomenclature divides fishes into two groups: "poisson industriel," or industrial fish, and "poisson marée," fresh fish.

I. INDUSTRIAL FISH

In 1968, 188,780 metric tons of industrial fish were landed--89% of total landings. Industrial fish primarily are canned or reduced. They are sardines, anchovy (Engraulis encrasicholus), mackerel (Scomber scombrus), bluefin tuna (Thunnus tynnus), skipjack (Katsuwonus pelamis), frigate mackerel (Auxis thazard), black skipjack (Euthynnus alleteratus), bonito (Sarda sarda) and 'espadons' (Xiphiides). Much industrial fish is sold fresh: 17,961 tons in 1968, equal to about three-fourths the landings of fresh fish. Also, small quantities are salted.

Tuna and Tunalike Fishes

Landings have fallen slightly in recent years; in 1967, they were 6,447 metric tons. Tunas are taken mainly by sardine vessels and by "madragues" (fish traps). Sardine fishermen fish seasonally for bluefin, which appear in autumn off Safi-Agadir area; catches are limited by inadequate gear, short vessel range, and fishing technique. The number of madragues and their catches have declined. Occasionally, some tuna are taken by artisanal fishermen. Expansion of tuna industry has been considered in development plans over the years, but actual accomplishments have been minor.

An expensive research effort in 1964/65 involving a French vessel proved inconclusive. Attempts to use present vessels in Senegalese area showed their inadequacies for distant-water fishing. Nevertheless, expansion of tuna fishery is integral part of future plans; it includes fishing the resources of the Gulf of Guinea. The task, though not impossible, will be formidable. It will require high capital investment, considerable experience in tuna fishing, competing with foreign fishermen, and selling in highly competitive world market.

Mackerel

The 7,753 tons landed in 1968 were nearly 20% below 1967 figure. The decline was reflected too in figures of the Office de Commercialization et d'Exploration (OCE); these showed 1968-69 exports of 3,808 tons worth about $1,180,000, down 22% and 17% respectively from previous period. On the whole, however, mackerel offers potential for greater exploitation. Development waits better vessels, exploratory fishing, additional export markets, and diverting more of catch to reduction.

"POISSON MARÉE" (FRESH FISH)

"Poisson marée" are sold on fresh fish market; also, considerable quantities are frozen for local consumption and export. Horse mackerel, hake, sea bream, and blue fish are principal species; gurnard, mullet, sole, and shark are also landed in important quantities.

In 1968, Casablanca and Agadir accounted for 14,942 tons of the 23,827-ton catch. Tangier, Kenitra, Safi, and Larache also had annual landings of over 1,000 tons. Trawlers and line-fishing and gill-net craft, motorized and nonmotorized, participated.

The two main markets for "poisson marée" are the large urban centers, especially their foreign population, and France. Casablanca is the most important single market; besides its own trawler catch, it receives fish trucked from Agadir and other ports.

Efforts to promote greater domestic consumption of fish have had mixed success. Low purchasing power and the traditional preference for meat are reasons given for low consumption. The rapidly growing tourist trade is expected to absorb greater quantities of fish. With ample resources available, expansion of the fishing industry depends on expansion of the domestic and export markets.

CRUSTACEANS

Crustaceans follow sardines in potential for expansion. Shrimp, primarily Parapenaeus longirostris, are most important. Annual landings, however, have fluctuated during past 5 years from 250 to over 1,000 tons. Information on catches seems inadequate to plan growth. More information will be needed on areas fished, techniques, catches by foreign vessels, and requirements for Moroccan investors.

Lobster, spiny and northern, are another fishery where local fishermen might be diverted from sardine fishery. Official statistics show only a modest catch of 40 to 50 tons annually; some landings are unreported. Also, catches by foreign vessels off the coast are excluded.

THE SARDINE INDUSTRY

By far the dominant sector of the Moroccan fisheries is the sardine industry. During 1963-68, sardines accounted for 70 to 85% by weight of total landings. The 1968 landings were 167,623 metric tons; the record year was 1966 with 251,876 tons. More than half the catch goes to reduction plants; the remainder, the better-quality fish, goes primarily for canning and, to lesser extent, to fresh-fish market.

Over 90% of all sardine landings are made at Safi, Agadir, and Essaouira, centrally situated on Morocco's Atlantic coast.

Port of Safi

Because a larger proportion of its landings is canned, Safi leads the other two ports in income from catch. In 1968, nearly 33,000 metric tons of sardines (raw-fish weight) were canned in Safi. It has 38 canneries and 6 fish-meal plants.

Most cannery workers are hired on part-time basis. Women on canning lines receive about 14 U.S. cents per hour. Salaries for men are higher and depend on type of work and condition of employment. A social security tax of 15% is assessed; employe and employer each contribute half.

There are 117 sardine vessels working out of Safi: most are wood, 15 to 18 meters long, 20 to 40 GRT, and have 120 to 149 h.p. In Safi, vessels are contracted to fish for specific plants. Also, some plants have their own vessels. Many fishermen augment earnings by farm work during off season.

Agadir

The lead for volume of sardines landed alternates between Agadir and Safi. Agadir received 114,000 tons (of 251,876) in 1966's record catch.

The number of sardine vessels based at Agadir varies around 95 annually. The average vessel is about 16 to 17 meters long, nearly 5 meters wide, 29 to 30 GRT, and has a 160 to 170 h.p. engine. The vessels usually fish near port. Unlike the situation at Safi and Essaouira, vessels are all independently owned.

Sales are arranged through local fishery office. During peak season, when potential landings are higher than demand, each buyer submits his maximum daily need; the buyer must be ready to take this amount every day. During peak periods, sailings are rotated so landings do not exceed total orders. When landings are low, the available sardines are allocated among buyers in proportion to quantity taken during peak season. There are 18 canners and 8 fish-meal plants.

As in other ports, sardines are off-loaded at dock by the tedious technique of shoveling fish into small wicker baskets, which are hand-passed up to the dock. If slated for canning, the fish are salted and boxed before loading on trucks for transport to cannery several miles away. Reduction fish are dumped directly into open trucks; at weighing station, a dye is put on reduction fish.

Essaouira

Less important than Safi or Agadir, Essaouira (Mogador) is easily the most picturesque. The port has 7 canneries, 2 fish-meal plants, and one freezing plant. Only 10 vessels are permanently based here; however, up to 60 arrive from other areas during height of sardine run. Vessels fish under contract with the plants. In 1968, nearly 30,000 tons of sardines were landed.

Other Ports

Casablanca, Al Hoceima, and El Jadida account for major share of sardines landed at other ports. All but a limited quantity are sold on fresh-fish market.

Sardine Prices

Prices generally are set annually after discussions among processors, vessel owners, fishermen, and government officials; the prices are published in a government decree. In 1969, prices fixed for sale of sardines destined for canning, freezing, salting, and export were in 2 categories:

1) Quality fish for industrial use, 50 count per kg. or less: Agadir--US$76 per metric

ton; Essaouira and Safi--$80 per ton. Vessel owners received $8 per ton of purchase price to amortize cost of nets. Balance is shared 60-40 by crew and vessel owner.

2) Low-quality fish or fish not fit for human consumption: Agadir--$20 per ton; Essaouira--$12 per ton; Safi--$13 per ton. No net bonus paid out of purchase price for such fish.

At each port, there is a government fishery office. Each lot of sardines going to canners is sampled. The sample is sorted by an official who separates canning-quality fish from noncanning quality. Size, freshness, and appearance are criteria. Proportion between the two in sample is basis for payment of entire lot.

For sardines higher than 50 count per kg., prices are negotiated in each community.

Sardines for reduction were: Agadir--$14.50 per ton; Essaouira, $17; and Safi, $18. A net bonus of $1 per ton is paid out of purchase price at Agadir and Essaouira.

Some Observations

The strength and viability of the Moroccan fishing industry appears related to sardine industry. By far the greatest amount of capital investment is in sardine canneries, fishmeal and oil plants, and vessels: 75 canneries, 18 meal plants, and around 250 vessels (mostly wood, small, and overmanned). The industry also accounts for major part of fishery earnings.

At the same time, it is generally recognized that the sardine industry could benefit greatly from more efficient equipment and improved techniques. The government can help because it sets price for fish, level of wages, cost of cans and other canning needs, and has roles in marketing, and in licensing vessels and plants. A solution is being sought to problem of how to introduce new and more efficient equipment in fishing and canning without displacing workers. This and other problems including shortage of capital and credit are being faced.

Consolidating canneries and diversifying and upgrading sardine products are other measures being pursued. OCE and the canners are working harder to find more export markets.

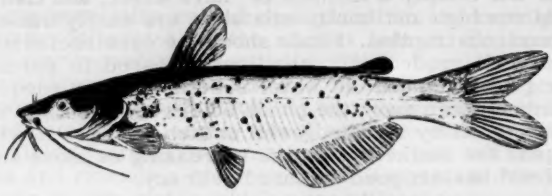
Fishing Changes Slower

In fishing, change has been slower. The question debated is how to innovate without harming owners and reducing jobs. One suggestion is licensing reduction plants around Ifni and to the south and drawing off excess vessels, fishermen, and plant workers from Agadir-Safi area. This probably would be effective if properly executed. Another suggestion would permit introduction of improved vessels to replace one or more old vessels, with possibly some type of work or earning guarantee to crews of replaced vessels.

Foreign investment in sardine and other fisheries is being encouraged by the government and could be helpful. Fiscal measures as an aid and incentive to modernize are another possibility being mentioned.

Considerable improvement is possible in the Moroccan sardine industry--but will require the cooperation of government agencies and the industry. Concerted effort is needed in sales, processing, production (vessel owners and fishermen), and in research to determine stocks and location of sardines.

FOOD FISH FACTS



CHANNEL CATFISH
(Ictalurus punctatus)

Catfish have been a popular and plentiful food fish through thousands of years. Folklore abounds with tales of catfish which sometimes grew to 6 feet in length and weighed over 100 pounds. There is a wide variety of catfish which includes the gafftopsail and sea catfish which live in the ocean. Some of the fresh-water catfish family includes the yellow, brown, black, and flat bullheads; the stonecat; the widemouth and toothless blindcats; more than 10 varieties of madtoms; and the white, blue, headwater, yaqui, and flathead as well as the channel catfish.

DESCRIPTION

All catfish have long barbels about the mouth used for locating food, are scaleless, and have heavy, sharp pectoral and dorsal spines. Channel catfish, considered by many to be the best eating, are easily distinguished from other catfish by their deeply forked tails, a relatively small head, and small irregular spots on the sides. The channel is the most active of all catfish and grows quite large, the world record is 57 pounds. A desirable fish to many sportsmen, it can be caught with a variety of baits and lures and provides considerably resistance at the end of a fishing line.

HABITAT

Most catfish inhabit warm, quiet, slow-moving waters. Channel catfish prefer large rivers and lowland lakes with clean bottoms of sandy gravel or boulders. They adapt readily to new environmental conditions and stocking this species in new waters is usually successful. Although catfish originally were found mainly in Mississippi basin waters, they now inhabit waters in many parts of the United States.

CATFISH FARMING

For many years the catfish market was adequately supplied by commercial fishermen who harvested wild catfish. In recent years the catfish population has decreased as has the number of men who harvest them. However, the demand for catfish has not declined and, because of this, more and more farmers have been changing their fields from agricultural activities into catfish ponds. In ten states, ranging west from Florida into Texas and extending as far north as Kansas and Missouri, approximately 26,000 acres were utilized in intensive catfish farming in 1968. The channel catfish is usually the species chosen for these ponds because of their choice flavor, adaptability, and faster growth. It is estimated that in a 210-day growing season, the channel catfish will attain a weight of $1\frac{1}{2}$ pounds, if not overcrowded. The recommended stocking per acre to attain this growth is considered to be 1,000 six-inch fingerlings. If more fingerlings are stocked per acre, the growth will be less in the same number of days.

The catfish farmer has a choice of procedures after his fields have been converted into ponds. He may buy fingerlings from other farmers and feed them to market size. Or he may breed the catfish, raise the fingerlings for sale, or use them to stock his own ponds and feed them to market size. Some farmers also dress and deliver the catfish to market or to processors.

(Continued following page.)

CATFISH FARMING (Contd.)

Raising catfish is not simply a formula of "have water, add fish, reap instant money." The initial investments run high and costly mistakes are easily made. Added to the cost of the land is the cost of pond construction. Ponds should be constructed in soils that hold water, the bottoms should be well graded and completely cleared to permit seining at harvest. Quality of the water is important and the water system must be adequate to get water to the ponds as well as draining water from the ponds before restocking. These are just a few of the problems that must be met by the successful catfish farmer. However, the future of catfish farming is bright and the market demand is increasing as more and more people are becoming aware of this fresh-water, pond-cultured delicacy.

CONSERVATION

The Bureau of Commercial Fisheries seeks and defines new and under-utilized fishery resources and develops improved harvesting methods and gear as part of its service to the United States fishing industry. To aid the increasingly important catfish industry, Bureau research personnel perfected a seining system with a mechanical haul and demonstrated its use in harvesting pond-cultured catfish. The mechanized seining and conveyor equipment reduced the time and labor required for harvest.

USES OF CATFISH

Catfish can be bought as steaks, fillets, whole dressed, and skinned dressed. The tender, white, nutritious flesh can be prepared in a variety of ways. It is good eating either baked, broiled, grilled, barbecued, smoked, sauteed, or stuffed. (Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 East Ohio, Room 526, Chicago, Ill. 60611.)

The Bureau of Commercial Fisheries has published an exciting, full-color booklet that is chock-full of ideas using tasty catfish. It is called "Fancy Catfish," Fishery Market Development Series No. 6 (I 49.49/2:6). For your copy, send 256 to the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

(Recipe p. 67.)

CATFISH CANTONESE--PLEASE WITH EASE

Did you know that commercially-raised channel catfish are rapidly becoming one of the more popular fresh-water delicacies on the market today? Gourmets insist that pond-cultured catfish have a flavor superior to most wild catfish. Specialty restaurants and drive-ins featuring catfish are already being built and others are in the planning stages to take advantage of this new popularity. Why? Probably the reason is the quality of the fish. Today's increasing market demand is largely supplied by an ever-growing group of farmers who are changing their fields from agricultural activities into catfish ponds. Ranging west from Florida into Texas and extending as far north as Kansas and Missouri, there were approximately 26,000 acres in ten states which were utilized in intensive catfish farming in 1968.

Catfish Farmers of America, a new organization, hopes to control the marketing of its products and maintain high quality throughout the entire rearing, processing, and marketing pattern. In order to assure that pond-cultured catfish are top quality, catfish farmers are using scientifically-proven techniques and balanced food formulas. Also important is the construction of the ponds which must have sloping sides and a relatively constant water depth, a little deeper in winter than in summer. The cleanliness and temperature of the water, the amount of oxygen in the water, and the absence of predators are only a few of the many precautions followed to produce a quality product.

According to the Bureau of Commercial Fisheries, all catfish are good eating--especially the channel catfish. This fish may be identified by its deeply forked tail, an easy check for the Consumer. Pond-cultured catfish are usually harvested at about $1\frac{1}{2}$ years of age and weigh from $\frac{3}{4}$ to $1\frac{1}{4}$ pounds. The flesh of catfish is white, tender, and tasty, and is an excellent source of high-quality protein, vitamins, and minerals.

Catfish may be prepared in dozens of different ways, but broiling is one of the easiest. "Catfish Contonese," a Bureau of Commercial Fisheries tested recipe, is particularly good eating. The fish are broiled with a lemony-butter sauce until flaky, then served with a hot sweet-sour topping. This topping is distinctive because it has just a touch of soy sauce to bring an unusually appetizing taste to this catfish entree. Look for pond-cultured catfish in your market and try "Catfish Cantonese" soon.

CATFISH CANTONESE

- 3 pounds pan-dressed skinned catfish or other fish, fresh or frozen
- $\frac{1}{4}$ cup melted butter or margarine
- $\frac{1}{4}$ cup lemon juice
- $1\frac{1}{2}$ teaspoons salt
- $\frac{3}{4}$ teaspoon paprika
- Dash pepper
- Sweet-Sour Sauce
- Julienne cut strips of fresh carrots, celery, and green pepper

Thaw frozen fish. Remove fins and tails. Clean, wash, and dry fish. Place fish in a single layer on a well-greased baking pan, 15 x 10 x 1 inches. Combine remaining ingredients except Sweet-Sour Sauce and vegetables. Brush fish inside and out with sauce. Broil about 6 inches from source of heat for 8 to 10 minutes. Turn carefully and baste with remaining sauce. Broil 8 to 10 minutes longer or until fish flake easily when tested with a fork. Place fish on a warm serving platter. Pour hot Sweet-Sour Sauce over fish. Garnish with vegetables. Makes 6 servings.

SWEET-SOUR SAUCE

- $\frac{1}{2}$ cup water
- 3 tablespoons catsup
- 3 tablespoons soy sauce
- 3 tablespoons sugar
- $1\frac{1}{2}$ tablespoons vinegar
- 2 tablespoons cold water
- 1 tablespoon cornstarch

Combine water, catsup, soy sauce, sugar, and vinegar in a 1-quart sauce pan. Heat. Combine water and cornstarch. Add to sauce and cook until thick and smooth, stirring constantly. Makes approximately 1 cup sauce

(Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 E. Ohio, Room 526, Chicago, Ill. 60611.)

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

BACK COVER: Lifting pound net to purse mostly alewife for unloading in lower Potomac River. (Photo: J. B. Rivers)